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A Mobile application for HIV education and stigma level measure: a case of Nairobi

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A Mobile Application for HIV Education and Stigma Level Measure: A Case of Nairobi

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Declaration

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

Thumbi Cameline Mukami Name of Candidate

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Abstract

The world wants to reduce HIV and AIDS spread by the year 2030 as part of the sustainable development goals (SGDs). HIV and AIDS has become the world's most devastating epidemic especially in developing countries like Kenya. Many people have died because of HIV and AIDS related illnesses since it was first reported in Kenya in 1984. To be able to achieve the sustainable development goals, HIV education and stigma reduction would be essential. The problem being studied is people living with HIV not being able to access service due to discrimination and stigma. HIV education and awareness programs have been implemented by various governmental and private bodies for which have improved the HIV prevalence rate. While the prevalence rate has improved, more needs to be done to advance access to the right information and reduce the stigma associated with HIV. The general objective of this research is to develop a mobile based application for PLHIV that will assist in information access as a means of education. The stigma is expected to go down by using anti-stigma messages and tagging of the same. The secondary objective is to reduce stigma associated with HIV through education on HIV and anti –stigma messages geo tagging. Among the main reasons for not seeking treatment include discrimination, stigma, wrong information, lack of support and drugs. Data collection involved both primary and secondary methods which included use of questionnaire, observation and literature review. The data was analysed using thematic analysis. This research sought to find how best to increase access to the right information as a means of education on HIV through use of the mobile phone. The software development life cycle was used for the development of the application. An android based mobile application was developed as a proof of concept for access to information on HIV care and geo tagging of anti-stigma messages.

Acknowledgements

I would like to thank Prof Ismail Ateya for his guidance and direction as he supervised my project. His patience and open door policy is something to be emulated. I would also like to acknowledge the lecturers in the Information Technology department, Strathmore University, for their suggestions and comments.

Finally, I would like to acknowledge my fellow MSc.IT classmates who enriched the discussion groups with the different experiences. I am highly indebted to the people mentioned above for the successful compilation of this project. They gave hope and a spirit of moving forward even when it seemed to have no end. God, bless you all abundantly.

Dedication

This research thesis is dedicated to my father, for his indefatigable support towards completing this program. It is also dedicated to my mother who continually supported and motivated me to finish my project and my siblings.

Table of Contents

Abbreviations/Acronyms

AIDS	-	Acquired Immuno-Deficiency Syndrome
APK	-	Android Application Package
ART	-	Antiretroviral Treatment
ARV	-	Anti-Retroviral
AVD	-	Android Virtual Device
CRUD	-	Create Read Update and Delete
FAQ	-	Frequently Asked Questions
GPS	-	Global Positioning System
HIV	-	Human Immunodeficiency Virus
KASF	-	Kenya AIDS Strategic Framework
MADF	-	Mobile Applications Development Framework
MAF	-	Mobile Application Framework
MDGs	-	Millennium Development Goals
NGO	-	Non-Governmental Organization
PHP	-	Hypertext Pre-processor
PLHIV	-	Persons /People Living with HIV
PLWHA	-	People/Persons Living with HIV/AIDS
SDGs	-	Sustainable Development Goals
UPHIAC	-	The Ubiquitous Personal Health Information Access
US	-	United States
VCT	-	Voluntary Counseling center
WHO	-	World Health Organization
WPI	-	Wisconsin department of Public Instruction
XML	-	eXtensible Markup Language

Definition of Terms

Acquired Immunodeficiency Syndrome:	It is an infectious disease that is caused by the Human Immunodeficiency Virus (Merriam Webster Dictionary)
Antiretroviral:	Treatment of HIV/AIDS that involves treatment of opportunistic infections (Merriam Webster Dictionary)
Human Immune Virus:	A disease that affects the human immune system due to the reduction of the CD4cells and is caused by infection with HIV (Merriam Webster Dictionary)
Prevalence Rate	Number of people in a population who have a disease at a given time for which the numerator is the number of existing cases of disease at a specified time and the denominator is the total population ("Prevalence rate", n.d.).
Stigma	Stigma is an unwanted and a demeaning attribute that an individual possesses which in turn reduces the individual's status in the eyes of society (Goffman, 1963)
Sustainable Development goals	Includes a set of 17 goals to end poverty, fight inequality and injustice, and tackle climate change by 2030 (UNDP ,2016)

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Chapter 1 : Introduction

1.1. Background of Study

HIV and AIDS have been with us for more than three decades. Being HIV positive brings negative encounters such as feelings of depression and feelings of isolation when one does not know where to go or what to do. In the early days, being HIV positive was perceived as a death sentence but since the introduction of ARV's, this is no longer the case. ARV's assist those living with HIV to live healthy positively. When one does not know where to go and what to do, support groups offer one the options to get help. Social support linkages and groups assist PLHIV in coping with HIV (McDowell, T.L, & Serovich, 2007).

Since the early days of the HIV epidemic, support groups have been recommended as an important psychological intervention for PLHIV. PLHIV have used traditional methods for support in coping with the illness from family, friends and community based organisations. PLHIV networks offer a key way for the enhancement of support to those affected by alleviating the negative encounters of living with HIV (Hudson et al., 2012). People facing similar issues are brought together by support groups for which may be formed by non-profit organizations (NGOs), local communities, advocacy organizations or people living HIV and AIDS (PLWHA). Support groups have been in use for over three decades with most being the key intervention used to help PLHIV deal with changes and challenges of the illness. Support groups purposes include helping members cope, neutralise stigma and allowing members to adapt to new behaviours Visser & Mundell, (2008).

The groups affected by HIV include children, young people, adults, women and men. The Kenyan HIV positive adolescents' death rate has gone up despite a general decline in the HIV prevalence in the country (Mercy, 2015). Between the year 2005 and 2015, the number of new HIV cases grew by an average of 7% per year which was one of the highest increase in the world (Oketch 2016). The HIV prevalence deceleration has been attributed to the improvements in care, more awareness and antiretroviral therapy. The main cause for adolescents' death is not adhering to medication (Mercy, 2015). Reasons for not adhering to treatment include misconceptions about HIV, fear of being discriminated and information from other peers that is misleading. From a report by the Kenya ministry of health (MoH), the deaths of about 10,000 HIV-positive teenagers are due to delayed treatment (Ruvanga 2015). Delayed treatment is

attributed to the fear of seeking medication, lack of awareness, education and the challenge of receiving harsh treatment in hospitals which deters one from seeking medication.

There are more than 36.9 million PLHIV and about 2 million new infections in 2014 alone and 41% of them not able to access the treatment required (Keepachildalive, n.d.). Lack of the right information leads people to make wrong decisions that have a negative impact on the affected and infected. A student from a school in Seme Sub County became a drop out due to his HIV positive status (Okun, 2016). The decision to have the student drop out was informed by wrong information that other students could be infected though touch and using the same facilities as the student (Okun, 2016). If the right information was present, this situation may have been averted.

Investing in education for adolescents would bring many benefits that stretch into the future adult life and even the next generation (Kilonzo, 2016). Stigma is commonly mentioned together with discrimination due to its close relation. HIV stigma and discrimination could be reduced by having an easily accessible solution to educate and inform. Education and information on prevention, treatment and keeping healthy would help reduce new infections through improved awareness. Furthermore, openness on matters concerning HIV would be improved which in the long run would reduce the new infections. According to the National Aids Control Council (NACC), an approximate 29% of new HIV infections in Kenya are among young people and the adolescents (Okun, 2016). More HIV awareness needs to be done both in school and out of school to get to zero stigmas by the year 2030 (Okun, 2016). Kenya has invested greatly in initiatives to reduce stigma and discrimination. Among the many initiatives include the *Kick out HIV stigma campaign* that is being spearheaded by the president of Kenya, Uhuru Kenyatta. The campaign seeks to engage Kenyan youth through the Maisha county football league where young people are linked to stigma-free HIV testing, treatment and care (UNAIDS, 2016). The campaign is a partnership of the United Nation, Kuza Biashara, the government, civil society and the football Kenya Federation (UNAIDS,2016). *Sauti skika* is also another group for young adults that airs out the views of the youth on stigma and provide support to each other. There is still need for more anti-stigma messages to encourage people to know their HIV status and increase the adherence to treatment (MoH, 2016).

In recent years, the Internet has been used as a resource for information on HIV/AIDS. Kenya was reported as having the highest Internet access and connectivity with fast speeds and

lowest internet rates (Elayne, 2014). Among the information sought from the Internet include side effects of treatment drugs, facts about HIV prevention and treatment, myths on transmission and rights on HIV/AIDS. The Internet offers a way to have information to improve awareness of critical health services and reinforce positive health living. It is for this reason that a mobile based solution to access information as a means of education would be a more convenient way to access information being sought. The potential of mobile phones to support effective service delivery in rural areas in Africa has been proven (Hellstrom, 2010). The traditional face-to-face meetings between patients and doctors have been unable to meet the huge health care demands of the growing population of patients including HIV/AIDS patients in developing countries Baguma & Mukalazi, (2013). This makes the mobile application a viable method of accessing information on HIV which would otherwise have been sought from health centres hence reducing the burden. Critical HIV services include support, testing, information, housing, employment and treatment. This study addressed the support and information service which was achieved by the android based application.

1.2. Problem Statement

HIV/AIDS is one of the biggest killers of teenagers and young adults in Kenya (Kilonzo, 2016). While Kenya has made great strides in improving awareness, adolescents and young people still bear the impact of HIV epidemic due to limited access to information, services and stigma and discrimination (Okun, 2016). Young people experience HIV related stigma that is a major barrier to accessing HIV care including testing and counselling (UNAIDS, 2016). Thus, there is need for a way out to assist in HIV education as a means of information access to reduce the effects of stigma and discrimination to improve access to care. Communication of correct information and increasing a person's knowledge on what one can do to prevent themselves are ways to reduce stigma (Cobb, 2014).

1.3. Research Objectives

The main objective of this thesis was to come up with a mobile application that assists in access to HIV related information to educate and subsequently reduce stigma and discrimination. The specific objectives of this research include:

i. To identify challenges to access of HIV care and services.
ii. To review existing tools and techniques used to improve access to HIV care and services
iii. To develop the mobile application
iv. To test the mobile application

1.4. Research Questions

This research seeks to answer the following key questions:

i. What are the challenges encountered in access to HIV care and services?
ii. What are the existing tools and techniques for improving access to HIV care and services?
iii. How will the mobile application be developed?
iv. How will the mobile application be tested?

1.5. Justification for the Study

People living with HIV /AIDS experience varying challenges with service access. Some may be due to harsh treatment through discrimination and at times are not able to make it to the clinics for support and counselling. Others may not want their HIV/AIDS status known due to their workplace culture or the relationship with their spouses. HIV related deaths are a burden to low income countries hence the need to have interventions to help in death reduction for which is expected by increasing access to education on HIV care and services. As is in figure 1-1, HIV was one of the main causes of death in 2012. This solution can be used to improve quality of health for PLHIV through education which is expected to improve literacy levels in matters HIV. With increased literacy levels, stigma and discrimination and new infections are expected to decrease. While it is expected to assist in information on HIV care, it could be used as a tool in the classroom for easy access to HIV/AIDS information. Namuddu (2015), argues that school based programs have great potential for HIV/AIDS prevention education.

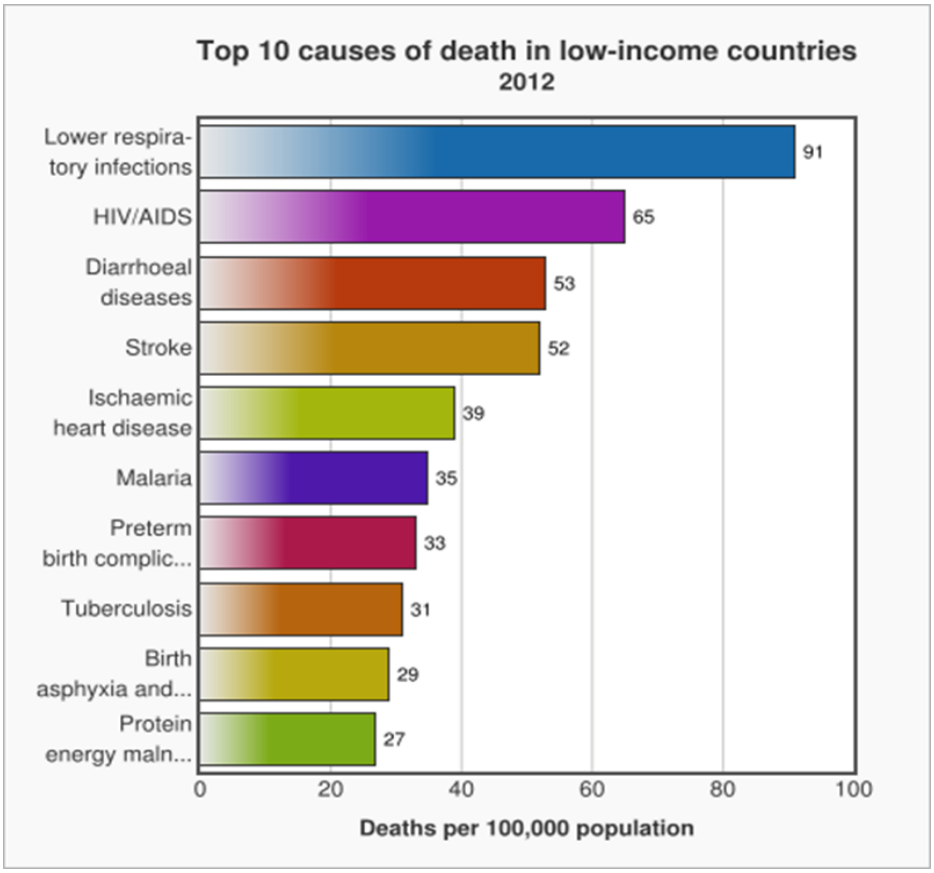

Figure 1-1 Top 10 causes of death in low income countries 2012 (WHO, 2014)

1.6. Scope of Work

The research focused on provision of education on HIV care and information as a service. HIV care in this study is in the form of HIV prevention, treatment and living healthy positively. This will be a means to reduce new infection rates, stigma and improved positive living .The data was collected within Nairobi County. The data collected focused on the relationship between information and reactions to having the right information, HIV support and care. Data collection methods that were used to capture the relevant information include use of questionnaires, observation and literature review.

1.7. Limitations

This research did not go into details on policies with regards to care giving and policy making on matters HIV/AIDS, information sharing and security of information. Information on HIV/AIDS may be presented in many forms including videos,images and text. This sudy did not dwell on video as a form of ducation.

Chapter 2 : Literature Review

2.1. Introduction

HIV is one of the main causes of death in the country (Avert, 2012). This is supported as is in Figure1-1. The early belief was that HIV had its origins in Kinshasa about the year 1920 when HIV crossed from chimpanzees to human beings (Avert, 2012). According to the Columbia Encyclopaedia (2015), there are two strains of the virus causing HIV: HIV-1 and HIV-2 with the variant HIV-1 being the cause for most of the cases of AIDS. HIV infects the CD4 cells that produce antibodies of the immune system hence weakening the immune system leaving a person vulnerable to opportunistic infections such as tuberculosis. Once the body's immune system is weakened, there is no cure hence one is required to take the antiretroviral drugs. In the early days of HIV in Kenya, there was too much stigma associated with the disease which was a determent for people in seeking treatment. The global number of people living with HIV was at an estimated 35 million as of 2013 with sub Saharan Africa having the highest number with almost 70% new infections of the global total (WHO, 2015). Nineteen million of the thirty five million persons living with HIV globally as of 2013 did not know their HIV positive status UNAIDS (2015). In 2014 there were about thirty seven million PLHIV with new infections falling by 35% since 2000 (UNAIDS, 2015). Kenya is among the world's largest HIV and AIDS stricken country as compared to other areas (WOFAK, 2012). Table 2-1 gives a summary of the global statistics on HIV from a UNAIDS report.

Table 2-1 Global statistics 2015(UNAIDS, 2016)

GLOBAL STATISTICS—2015
➢ 17 million people were accessing antiretroviral therapy
➢ 36.7 million [34.0 million–39.8 million] people globally were living with HIV
➢ 2.1 million [1.8 million–2.4 million] people became newly infected with HIV
➢ 1.1 million [940 000–1.3 million] people died from AIDS-related illnesses
➢ 78 million [69.5 million–87.6 million] people have become infected with HIV since the start of the epidemic
➢ 35 million [29.6 million–40.8 million] people have died from AIDS-related illnesses since the start of the epidemic

From a report in the year 2012, Kenya had the fourth largest HIV epidemic in the world with 1.1 million orphans due to the epidemic with an estimated 1.6 million persons living with HIV and about 57000 dying from AIDS related illnesses (AVERT, 2012). Currently there are more than 1.8 million PLHIV. Figure 2-1 is a representative of the statistics of HIV in Kenya as of 2013.

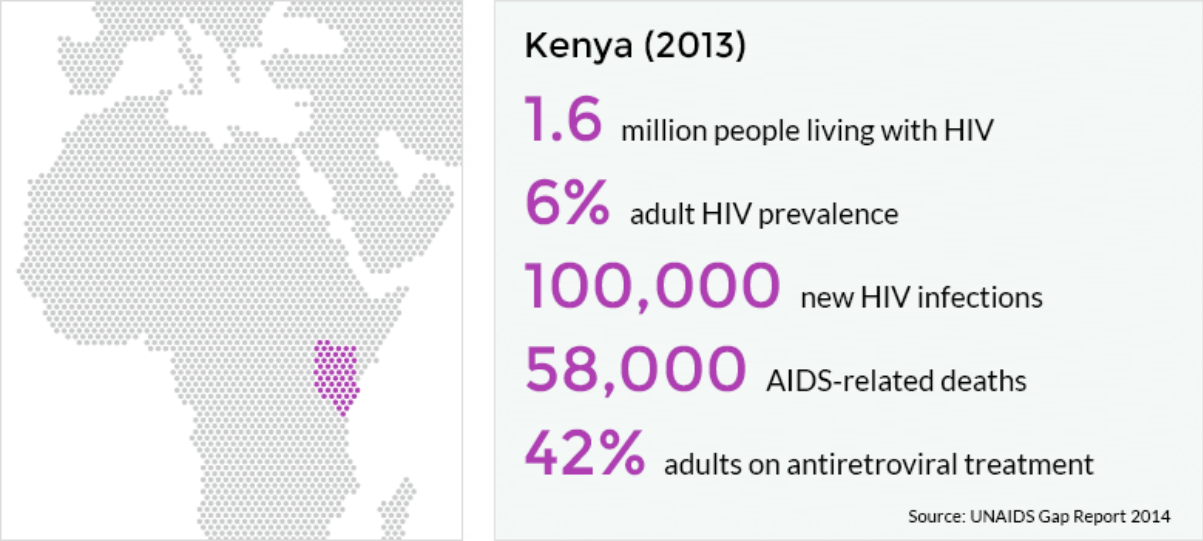

Figure 2-1 HIV and AIDS in Kenya 2013 (Avert, 2014).

From various reports, there is a significant number of people who do not know their status and those who do are not taking medication for varied reasons. Reasons for not taking medication range from: not being able to afford medication; lack of food; fear of being stigmatized; forgetting to take medication; not finding HIV centres and misconceptions about ARVs.

2.2. Challenges to service access

People living with HIV face several challenges which range from seeking treatment, stigma and discrimination, lack of support from family and the society, lack of affordable medicine and limited information. From a report by Veinot et.al misinformation, stigma and limited Internet access are some of the barriers to service access which will be discussed in this study.

2.2.1. Location of health Centre

Health service Centre's located in the rural areas may not be available in all locations and when available, there may be limited resources. This makes the ability to act as a stable source of information a challenge. Veinot et al., (n.d.) goes on further to point out that some service organizations may be reluctant to provide information on HIV due to the complexities and possibly not up to date information. The complexities of HIV information dissemination include not knowing how to handle situations where one is positive and the associated confidentiality expected. Often people find it hard to divulge information on HIV.

2.2.2. Unreliable Internet access

The Internet can be a valuable source of information though with slow internet, access can be inhibited. With improved Internet access, it is easier for people living with HIV to access information with ease. Noting that Kenya has a reliable Internet connection in most parts of the country; a mobile based application may be a reliable way of information access. The use of mobile phones is a reliable mode of information access as one can travel to a place with reliable connection for areas with unreliable connection.

2.2.3. Misinformation

Misinformation is the unintentional spread of inaccurate or false information (Veinot et. al., n.d.). They further say that misinformation spread can be facilitated by the ease of accessing information on the Internet. The misinformation can fall under three categories: information that challenges the local existence of HIV; mistaken notions about how HIV is transmitted; and unsubstantiated claims about treatment and cure. Misinformation can be damaging to people who accept the wrong information. Wrong information may also lead to the lack of support from families and the society which in the long run affects the gains made on new infection rates. Drivers for misinformation may also be fueled by lack of local healthcare providers with expertise in HIV. This mostly is a characteristic for those living in the rural areas and some semi urban areas. From a report by NACC, 2017 factors that have affected the rate of HIV infection are: incorrect perception of risks on HIV; failure to resist forced sex from partners; limited knowledge on sexual behavior and condom use. The study focused on providing information in a more easily accessible way maintaining the validity and up-to-datedness of information. Information from the Internet may be distorted depending on which sites are accessed. A mobile

application with a more solid structure that provides a one stop shop for information was proposed to improve on the correctness of information being sought. The correctness and credibility of information was ensured by using credible sites of information on HIV such as UNAIDS. Figure 2-2 gives summarized barriers to accessing HIV care of which lack of awareness is one of the barriers.

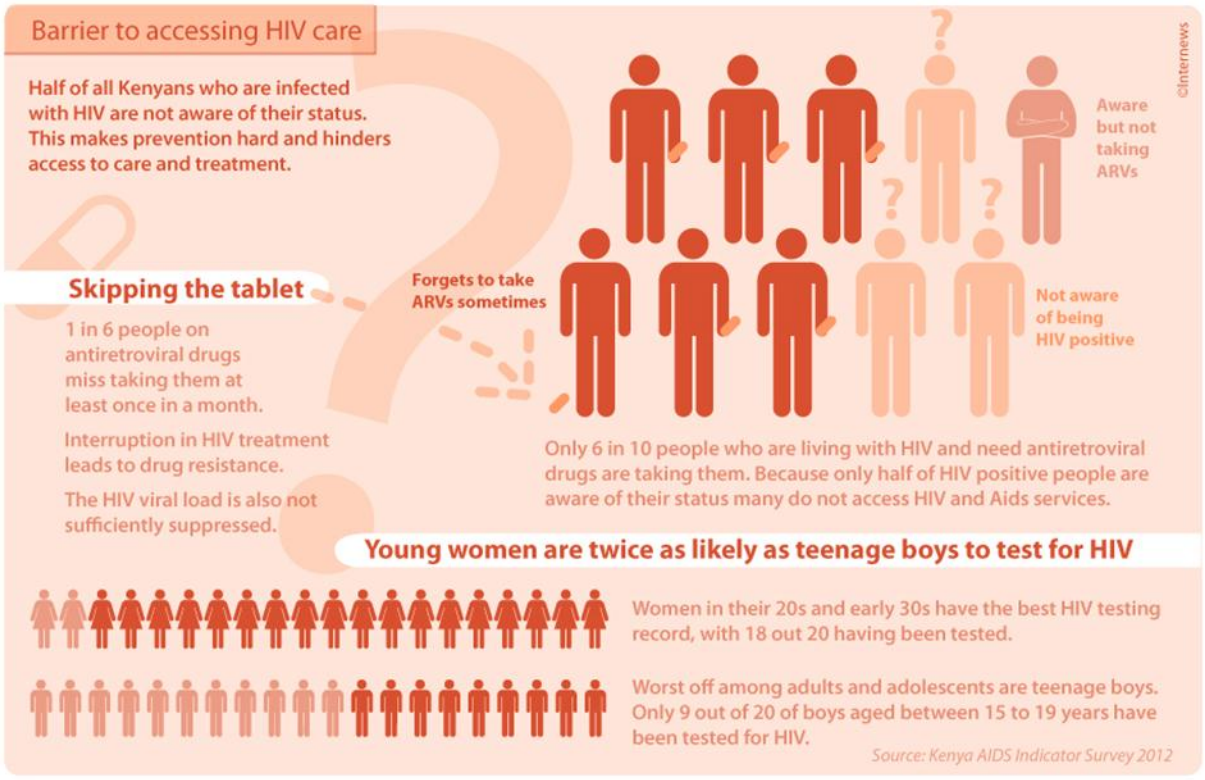

Figure 2-2 Barriers to accessing HIV care. (Internewskenya, n.d.)

2.2.4. Stigma and Discrimination

Stigma is a form of prejudice that rejects an individual or group of people because they are seen to be different from the norm or ourselves (Veinot et al, n.d). It is assumed that discrimination is instigated by lack of the right information and one's perception towards PLHIV due to fear and ignorance. Stigma and discrimination of PLHIV has been reported by various authors such as Kekana M.O (2011). Social stigma and discrimination is a barrier to seeking HIV services. Stigma can either be felt or perceived. Social stigma can be felt when the community does not offer support by shunning away those with HIV from participating in the various activities. It is also felt when those with HIV seek to interact with others in the community and are shunned away. From data by UNAIDS (2014), children get discriminated for their status as

other children are not allowed to play with those of a perceived or positive status. This could be averted by having people being informed with the correct information. It is for this reason that a mobile application to assist in easy information access as a means of education was proposed. Communication of correct knowledge and increasing a person's knowledge on what one can do to prevent themselves are ways to reduce stigma (Cobb, 2014). There are different types of stigma as in Figure 2-3.

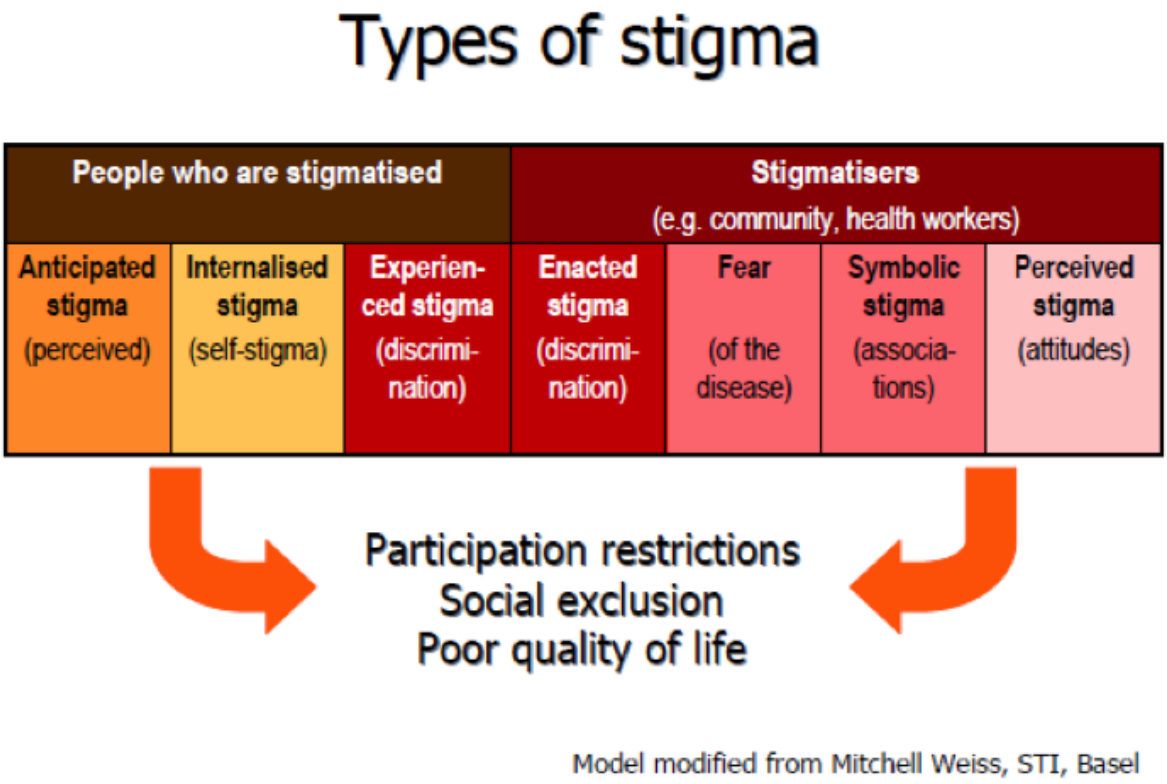

Figure 2-3 Types of Stigma (Cobb, 2014)

From the figure 2-3, people who are stigmatised experience perceived, enacted and self-stigma. In those type's, education on how to care for HIV infected and HIV information would assist to reduce the rate at which the stigma is propagated. Per Lisanne et al (2003), perceived stigma refers to an actual or imagined fear of the attitudes of a society and the possible discrimination arising from an undesirable disease or associations with a group. Stigmatisers would be better equipped with handling those with HIV by making available the right information. In both cases

of stigma, education on HIV care and information plays an important role in reducing stigma which was the focus of this study. HIV/AIDS stigma is a barrier for programmes on HIV prevention and treatment which entails part of the HIV care (Sayles et al, 2008). Figure 2-4 is a brief conceptual framework for HIV/AIDS related stigma.

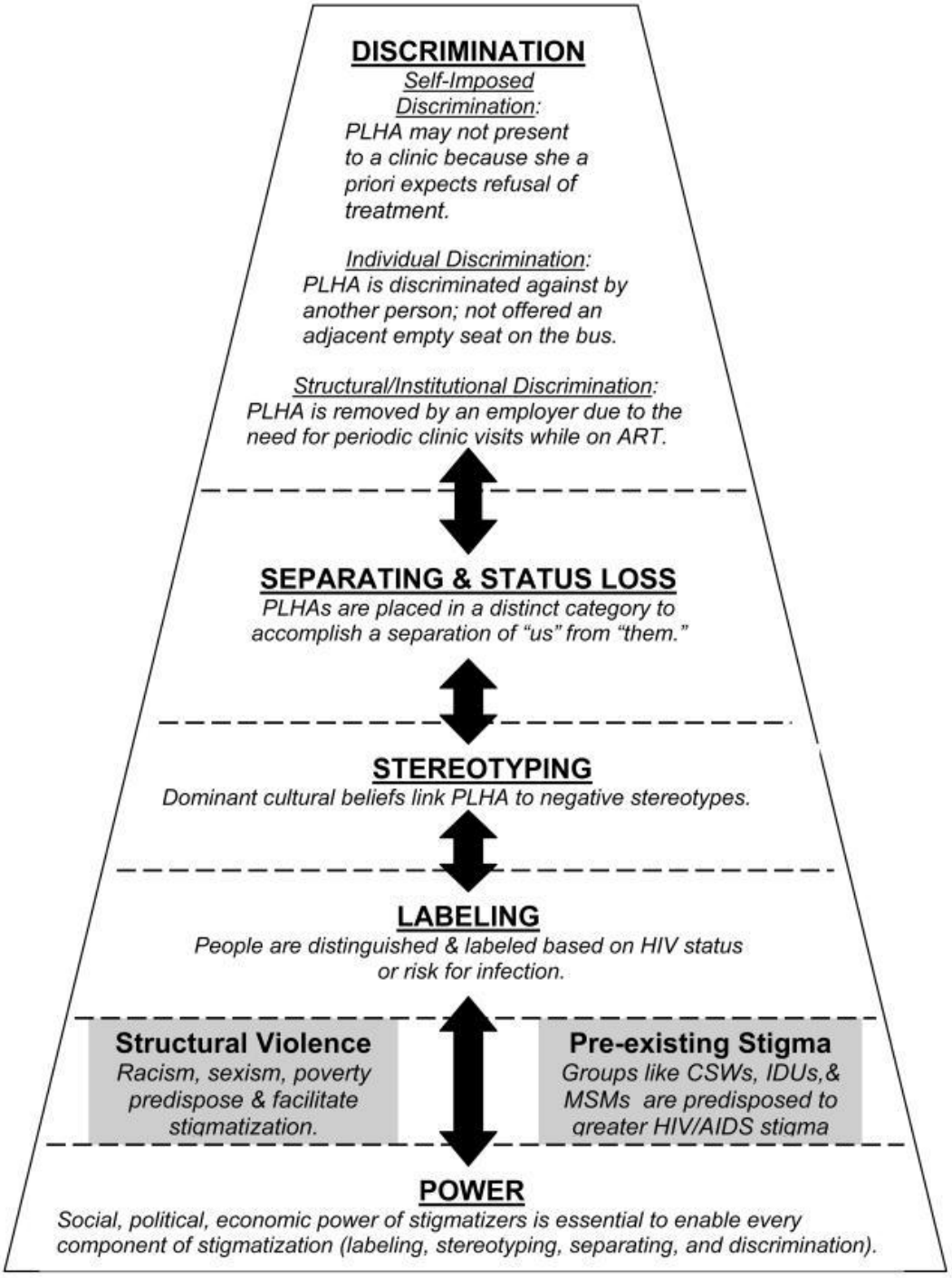

Figure 2-4 Conceptual framework for HIV/AIDS related stigma (Sayles et al, 2008)

Stigma has been studied over the years with varying findings about causes and outcomes of stigma. Per Holzemer et al, there are two distinct components that influence and affect stigma and the stigmatizing process. These are contextual factors: environment and the healthcare system and agents.

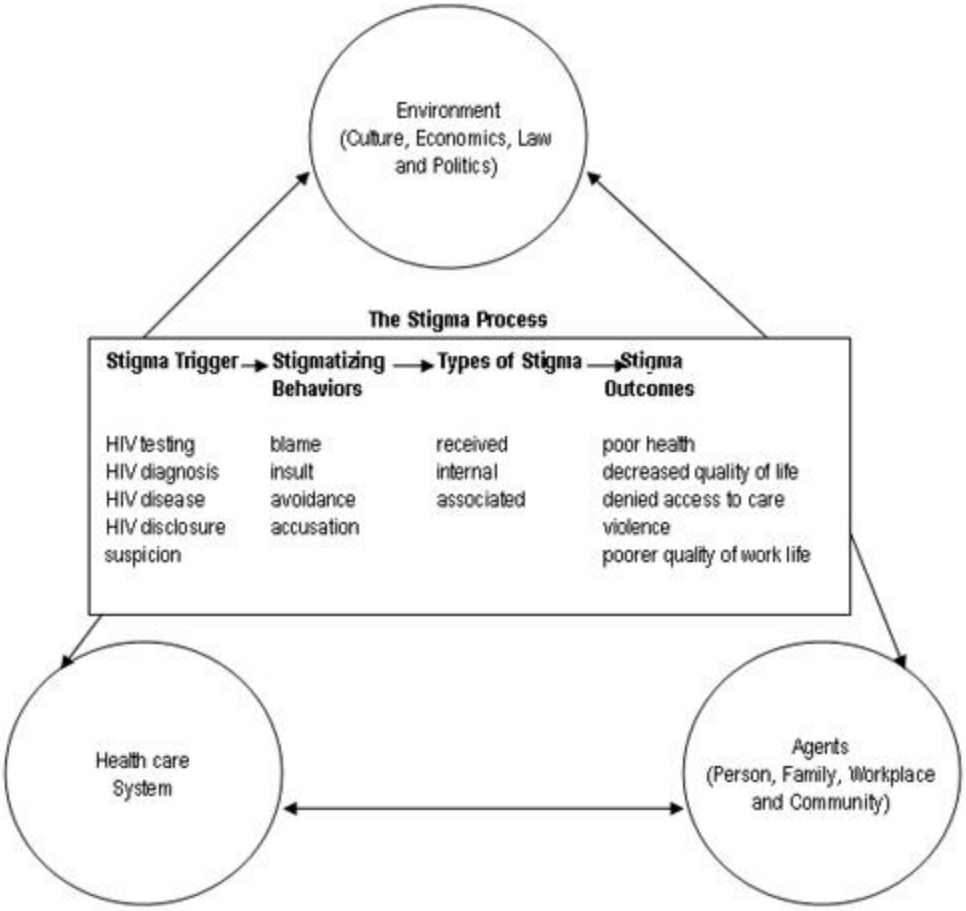

Figure 2-5 A Conceptual Model of HIV/AIDS Stigma from Five African Countries (Holzemer et al, 2007)

The model may be used to identify areas appropriate for testing and design of stigma reduction interventions (Shukla, 2009). The model shows the stigma process being composed of four different dimensions including triggers of stigma, stigmatizing behaviours, outcomes of stigma and the types of stigma (Holzemer et al, 2007). From the model, stigma affects a person's quality of life in terms of care and treatment. It is also assumed that in the model, going for treatment is a form of trigger for individual stigma. This is in the sense that when one is taking medication, there is the knowledge that one is HIV infected hence leading to being stigmatised. Among the interventions proposed is counselling by nurses and having knowledge on how to deal with HIV/AIDS stigma. HIV disclosure becomes a trigger for stigma when one lets another person know of their status and they are discriminated due to their status.

2.2.4.1. The PANCAP stigma reduction framework

The PANCAP stigma reduction framework was developed by the Caribbean people to deal with the stigma and discrimination that was being experienced (PANCAP, 2013). It is built around three key modules: health and development, collective empowerment and social justice and gender equality. The framework outlines a process that guides countries to identify the focus of stigma and discrimination response. PANCAP is the PAN Caribbean partnership against HIV and AIDS. This framework is because of multiple partners that include governments NGOs and development partners. The focus areas of this framework are as below:

1. An environment that fosters universal access to HIV prevention, treatment care and support services
2. An expanded and coordinated multi-sectoral response to HIV
3. Prevention of HIV transmission
4. Treatment care and support
5. HIV and AIDS services capacity development
6. Monitoring evaluation and research

The Table 2-2 focuses on tools and information sources that are evaluated by the PANCAP framework and accompanying strategic interventions, resources and considerations for monitoring and evaluating the process. From Table 2-2, education and use of anti –stigma toolkits have been proposed as strategies to reduce HIV stigma and discrimination. This study adopted the same strategy in a bid to reduce stigma and discrimination. Anti-stigma toolkits will be in the form of tagging of anti-stigma messages and information on HIV prevention and treatment as a means of education.

Table 2-2 PANCAP framework tools and information sources (PANCAP, 2013)

Using Resources	Key sources of evidence at the national level	Strategic interventions	Existing regional and international resources
Health and development	• National HIV Strategic Plan • National Strategic Plan for Health • National Development Plan • *Epidemiological* information from country (or from neighboring countries) such as key DHS indicators • Reports and information from PLHIV groups, key populations, networks, and service organizations	• Stigma-free services where key populations feel at ease accessing services • Guarantees related to confidentiality • Outreach mechanisms with organizations and key leaders of populations affected by HIV • Development of services based on needs of specific populations (PLHIV, persons w/ other health issues, persons highly vulnerable to HIV)	• PANCAP model codes of practice[1] • PANCAP model condom policy[2] • Workplace policies • Other: UNAIDS , Pan American Health Organization, Stigma Action Network (SAN) • CARICOM development plan
Social justice and gender equality	• National laws • Municipal regulations • Policies and guidelines to health, justice, and equality • Legal assessments and information from mechanisms for identifying S&D (stigma index, key DHS indicators, service delivery surveys) • International treaties • Women's organizations • MSM, SW and transgender organizations	• Stigma-reduction programs with lawmakers and opinion leaders who shape norms and policies • Creation of an enabling environment (moving from prohibitive to protective) o Law reviews and advocacy campaigns to change harmful laws o Confidentiality policies o Anti-discrimination workplace policies, training, and enforcement • Knowledge of rights and suggested services for PLHIV	• PANCAP Model Policy[3] • PANCAP Model Legislation on stigma and discrimination[4] • Other: UNAIDS, International Development Law Organisation (IDLO), United Nations Development Program (UNDP) and Stigma Action Network (SAN)
Collective Empowerment	• Capacity assessments of health providers, associations of health and other professionals, and nongovernmental organizations • Monitoring systems (service use: who is accessing and who is not; service quality: prevention, uptake in testing, service satisfaction) • Education, Labour and Tourism sector involvement	• Capacity building in various areas depending on need • Alliance building and strengthening of networking mechanisms (nurses association, etc.) • Citizen monitoring and evidence-based advocacy • Social capital of marginalized, including opportunities for participation in policy dialogue	• PANCAP HIV Anti-stigma tool kits[5] • Jamaica Reporting and Redress System • CRN+ Human Rights Desks • *Understanding & Challenging HIV & Key Population Stigma & Discrimination: Caribbean Facilitators Guide* • Others: UNAIDS and Stigma Action Network (SAN)

2.3. Tools/Techniques to improve HIV care and service access

Varying tools and techniques have been used for improving access to HIV care that range from education, training, testing, policy making and ARV access. The Kenya AIDS strategic framework (KASF) 2014/15-2018/19 is one of the strategies that is geared towards improving HIV related response.

2.3.1. Education

To achieve the education element there are various strategies such as condom distribution, voluntary medical male circumcision among others that were discussed in this study. The government of Kenya has actively promoted condom use since the year 2001 through mass distribution (Avert, 2015). Despite this initiative by the government, the use of the condoms is not guaranteed as some people prefer not to use. Strategies have been used to increase knowledge of preventing mother to child transmission (PMTCT) and increased ante-natal care through making the service free at public facilities. This includes giving out ARVs to those who test positive through the universal HIV testing uptake among pregnant women (Avert, 2015). The Beyond Zero campaign was an initiative by the then first lady Margaret Kenyatta to assist in health problems of mothers and children in Kenya in 2014. This was part of the initiatives outlined in the strategic framework towards HIV control and promotion of maternal health. From the beginning of 2010 the government started implementing programmes that were geared towards encouraging male involvement in PMTCT. This has received low involvement that stood at 4.5% in 2014 (Avert, 2015). Voluntary medical male circumcision (VMMC) has been working since the year 2008 as a HIV prevention programme. This has largely been adopted with many males going for circumcision. ICAP has been in partnership with the MoH to provide technical assistance and capacity building at the national level (ICAP, 2017). This is mainly at the Southern and Nyanza areas. ICAP is involved with HIV research initiatives, accelerating children's HV/AIDS treatment and nursing and midwifery education projects. ICAP has recently completed several projects that assist in HIV response that are:

i. ARTIC study

This was a study by ICAP in Nyanza province to establish a sample bank to understand the association between inflammatory and coagulation biomarkers and HIV related outcomes.

ii. APHIA plus (2011-2015)

Expansion and strengthening of HIV care and treatment facilities in central and Eastern province was the focus by ICAP though the APHIA project.

iii. Tegemeza (2011-2014)

This program was intended to assist in provision of quality HIV care and treatment services for adults and children funded by PEPFAR through CDC (ICAP, 2017)

iv. Mother and infant retention for health study (2012-2015)

This study focused on finding out the effectiveness of patient follow-up to engage and retain in care the newly identified pregnant positive women and their babies as a comparison to the current standard of post-partum care (ICAP, 2017).

2.3.1.1. Webcasts

Webcasts have been used to broadcast HIV content on the Internet. The cmetoolkit is used to improve quality for healthcare providers. These include physicians, nurses, pharmacists and case managers. The main contents include:

a. PEP and PrEP updates
b. Inflammation, aging, and HIV
c. When not in care exceeds not diagnosed in HIV
d. Treatment selection, switching therapy, and other challenges
e. Bone health and other safety issues
f. Clinical and practical updates in PrEP
g. Advances in HIV treatment

2.3.1.2. HIV/AIDS policy kit

The Wisconsin department of Public Instruction [WPI] came up with the school HIV/AIDS policy kit to address policy development and procedures addressing issues relating to HIV/AIDS in school communities. The kit is for school board members, nurses, teachers, district administrators and other school staff.

2.3.1.3. HIV Prevention Kit

UNAIDS has been on the fore front in the fight against HIV/AIDS and came up with the HIV prevention toolkit in the year 2008. This kit was developed for managers at the national and

sub national levels who are in charge of implementing prevention programmes. The toolkit assists one in doing the following:

a. Providing you the programming essentials
b. Linking to practical tools to assist programme/project managers
c. Validating your HIV prevention programming decision-making process
d. Prioritizing HIV prevention measures for different HIV epidemic scenarios
e. Accessing lessons learned and other resources
f. Providing the latest HIV news, data & info, and useful sites
g. Requesting feedback

2.3.1.4. HIV Training kit

The training toolkit is a collection of resources for developing, delivering and evaluating training on HIV related topics and skills for healthcare providers. This tool can be used for preparing and presenting HIV/AIDS training. Topics that are addressed include preventing mother to child transmission of HIV, opportunistic infections, voluntary testing, counselling and anti-retroviral therapy.

2.3.2. Policies/Strategies

Policies have been used to define how to do things which include HIV response areas. The HIV education policy which was published in 2013 is one of those (Avert, 2015). The policy gives an overview of the HIV/AIDS status in the education sector; prevention; treatment care and support; HIV/AIDS at the workplace; managing the HIV/AIDS response (USAID, 2014). The policy emphasizes that strategies must be gender sensitive (Avert 2015). The final policy on HIV and AIDS 2013 was as a result of trying to improve the HIV the response of pupils in schools, health care personnel, teaching staff and the general rights of PLHIV. According to Avert 2015, the KASF consists of four main objectives which provide a road map for the HIV response:

i. Reduce new HIV infections by 75%
ii. Reduce HIV- related stigma and discrimination by 50%
iii. Reduce AIDS related mortality by 25%

iv. Increase domestic financing of the HIV response to 50%

The Kenya research agenda was developed to provide direction and guidance on interventions that address the practical elements of strengthened research coordination, implementation, dissemination and uptake. The agenda is meant to accelerate the KASF results. The objectives of the agenda are:

1. Providing a national framework to guide HIV research
2. Defining HIV research priorities for the next five years
3. Facilitating coordination of HIV and AIDS research
4. Serving as a tool for resource mobilization and allocation for HIV research

The one country monitoring and evaluation framework assists the communication and information sharing between the county governments and the national levels of government. It also provides a robust approach for evaluation of KASF (NACC, 2017). The effectiveness of the framework are measured using critical surveys, evaluations and surveillance.

2.3.3. Mobile Applications

Several mobile applications have been used to improve access to HIV services which range from information dissemination, testing centres location, reminders, match making and many more. Among the applications include facing AIDS, the body, HIV atlas, HIV risk calculator and HIV plus. Most of these applications were developed by the US department of health. For this research the top apps by health line in the year 2016 were discussed.

i. Facing AIDS is a mobile application that helps reduce stigma by having a user send a photo via text or email and uploading it to Facebook to let everyone know they care. It is also meant to promote HIV testing. This application is for iPhone users.

ii. The AIDS info HIV /AIDS glossary of terms app assists one to find definitions to HIV related terms (Carey & Fields, 2016). The app provides the information in both English and Spanish featuring an audio tool that assist to hear how the word is pronounced in either language. This makes the app useful for students, patients and health professionals. The app runs on Android and Apple devices.

Figure 2-6 AIDS info (Carey & Fields, 2016)

iii. The body assist one to get access to all content on the Body.com website. This includes latest news, ongoing research and other topics on HIV and HIV related illnesses. This app also has personal stories from people where one can connect. The beauty of the app is that it has an easy to navigate menu allowing one to go to topic of choice. The app runs on both Android and iPhone.

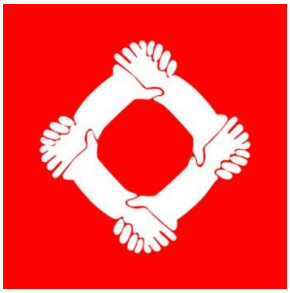

Figure 2-7 The Body (Carey & Fields, 2016)

iv. Care4today is an app that assist one in taking medication. It reminds one when to take their medication. This is useful as when one is required to take multiple medications there may be confusion. The app can also populate the information on how one us taking medication to a doctor or care provider.

Figure 2-8 Care4Today (Carey & Fields, 2016)

v. The HIV testing and care services locator assist a user to locate health centres, testing HIV services, service providers and housing providers. The location search is based on one's current location. The app allows a user to input what they require and all options available are displayed. The app runs on iPhone and was developed by AIDS.gov.

Figure 2-9 HIV Testing and Locator (Carey & Fields, 2016)

vi. HIV Plus is an app by the US government that assists users to access services such as pill reminder, appointment reminder and pharmacy finder.

vii. HIV Atlas compiles information relating to HIV, tuberculosis and malaria putting it in an easy format. Just as the Care4today, this app reminds a user to take their medication (Carey & Fields, 2016.).

Figure 2-10 HIV Atlas (Carey & Fields, 2016)

viii. HIV risk calculator assist a user in knowing their risk of contracting sexually transmitted disease. The user learns of the different levels of risk for all types of sexual contact and steps for prevention (Carey & Fields, 2016.) The app runs on Android based phones.

Figure 2-11 HIV Risk Calculator (Carey & Fields, 2016)

ix. Liverpool HIV iChart

When taking HIV related medications it can be confusing as one is required to take different medications. The application assists a user to make decisions on the various drug interactions. The app outlines the risks and likely side effects of combining many medications irrespective of whether prescription or over the counter drugs. The application is for use by iPhone users.

Figure 2-12 Liverpool HIV iChart (Carey & Fields, 2016)

x. GoodRx application

Medications for treating HIV may be costly and knowing where to get a better deal in terms of cost may be very useful. One can buy drugs more expensively in certain stores compared to other stores. The app assist a user to find the cheapest price for any prescriptions which also includes a tool that can find the best price for all medications in one place. This app saves a user the time to keep looking for cheaper drug options. The app runs on Android phones which could reach a lot of users.

Figure 2-13 GoodRx app (Carey & Fields, 2016)

In summary most of the discussed applications focus on providing a single service. Taking the risk calculator app a user can only calculate the HIV risk and no other service. This means that if one requires a different service they may need to download many applications to get all they may need. The proposed application allows a use to access different services in one. A user can access information on HIV, research, event and chat.

2.5. Models/frameworks

Varying models and frameworks have been developed to assist developers in building the required applications. Some of the frameworks in existence include framework for the emerging mobile commerce applications (Varshney and Vetter, 2001), the mobile agent platform (Lee, 2010), Oracle mobile application framework (Oracle, 2014) and the enterprise Mobile Applications Development Framework (MADF) (Unhelkar & Murugesan, 2010). Other frameworks are the Sales force Mobile SDK which is a framework that allows for native, hybrid and web mobile app development. The MADF provides a good reference for the mobile applications design and implementations Unhelkar and Murugesan, (2010) as is represented in Figure 2-6

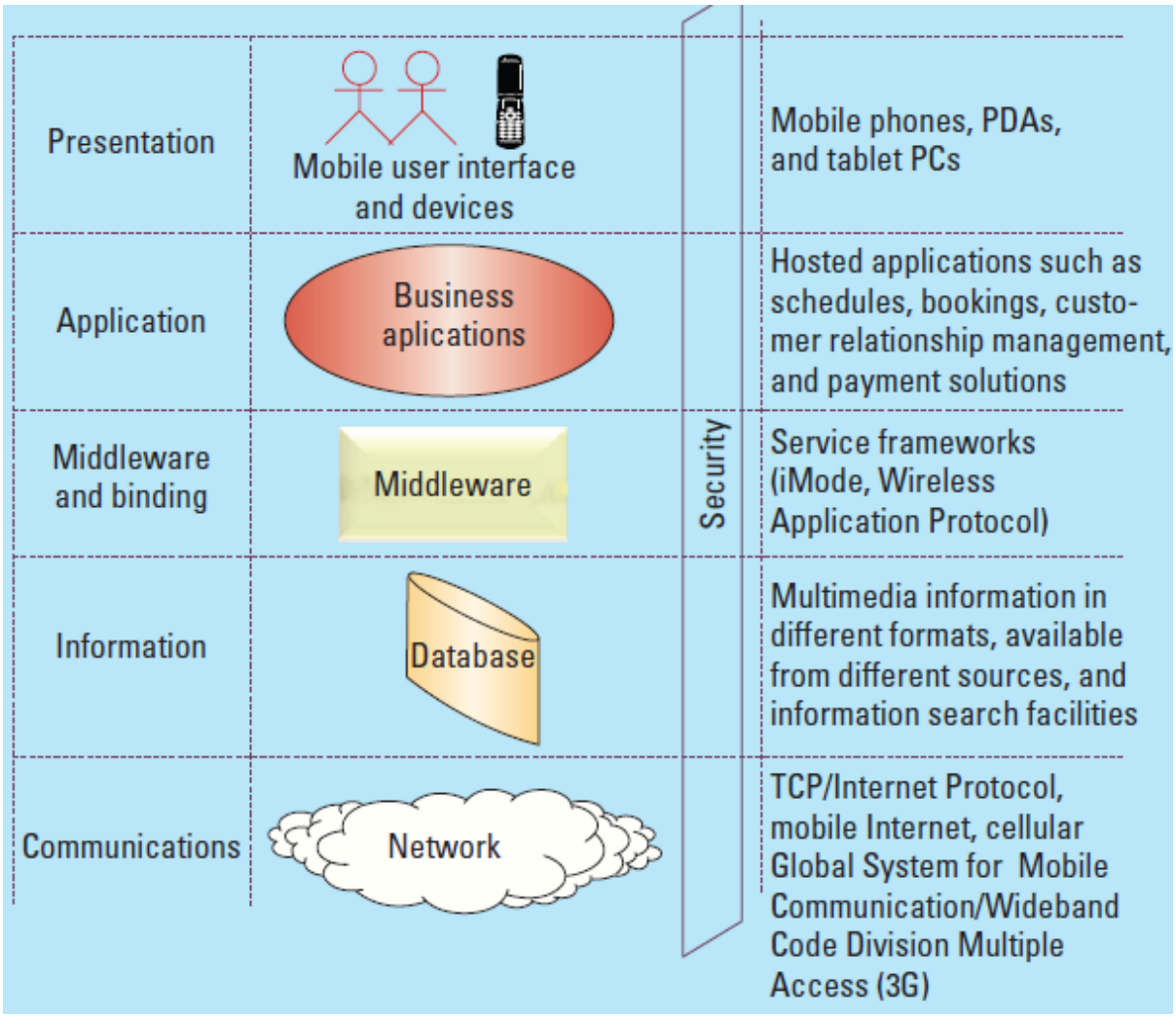

Figure 2-14 the enterprise mobile application development framework (Unhelkar & Murugesan, 2010)

The framework by Unhelkar and Murugesan (2010) was mainly for use in enterprise mobile applications. According to Unhelkar and Murugesan (2010), the MADF framework brings together elements of software architecture and design and the required supporting communication infrastructure (network and protocols) and the different types of information accessed across multiple sources. The framework considers usage of communication infrastructure such as Transmission Control Protocol (TCP) and the Internet protocol (IP). It allows multiple-access to the applications back end from a single mobile application or several applications. Per Laakko et al., (2008) there is an increasing need for user friendly and interoperable mobile applications in the health and wellness domain. The Ubiquitous Personal

Health Information Access (UPHIAC) platform was developed to offer a wide range of telemedicine and wellness applications as in Figure 2-7. The UPHIAC platform adopts a new technical approach using a local database solution for caching of information at the mobile terminal. The platform applies a document-based approach providing a versatile and reliable way of sharing and collaboratively complementing of health information including standard information model documents (Laakko et al., 2008). The platform can be used as a basis for developing new applications for specific purposes (Laakko et al., 2008).

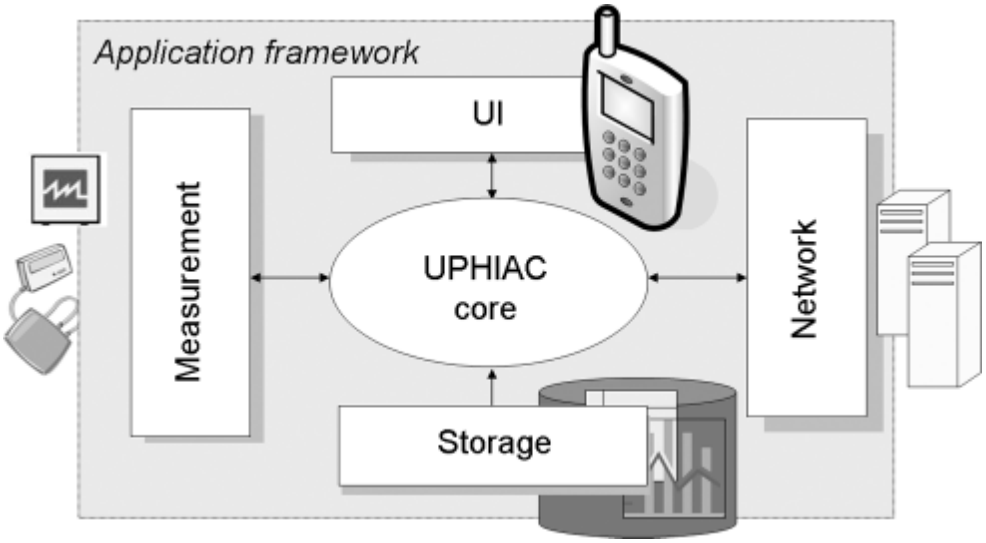

Figure 2-15 the UPHIAC Application Framework (Laakko et al., 2008)

The Oracle mobile application framework (MAF) is a hybrid mobile architecture that uses HTML5 and cascading style sheets (CSS) for the user interface, Java for the application logic and Apache Cordova to access device features like e-mail (Oracle, 2014). This architecture allows for a cross platform use where an application can be built to run on Android and iPhone Operating System (iOS) devices. MAF allows for reuse of the business logic. The various components of the framework are as shown in Figure 2-8.

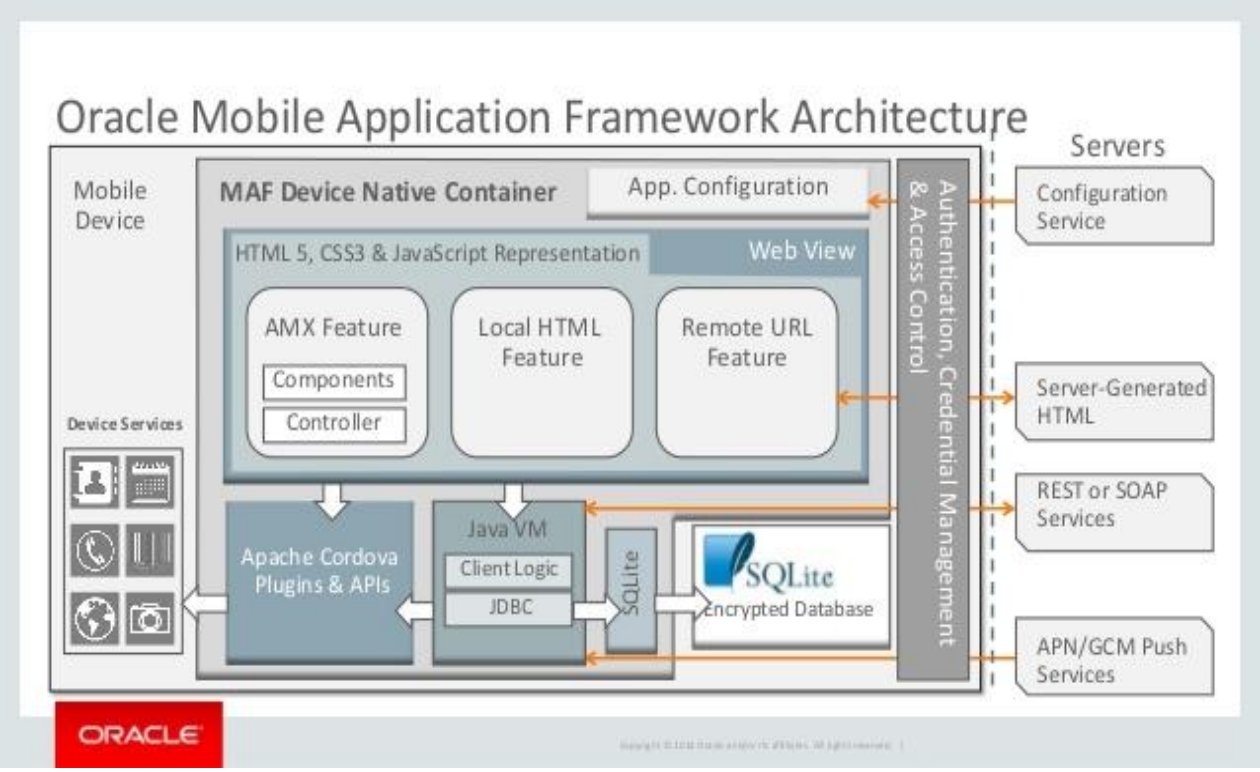

Figure 2-16 Oracle mobile application framework (Oracle, 2014)

MAF applications consist of one or more application features. An application feature is a reusable, self-contained module of application functionality with each feature performing a specific task.

2.6. Architectures

A mobile application refers to software programs that perform a specific function for a user or another application. Mobile applications are services or applications that can be pushed to a mobile device or downloaded and installed locally. These applications rely on an architecture to work. Mobile phones have been used to serve many functions from personal use to business use. There are three types of mobiles applications as is depicted in Figure 2-9.

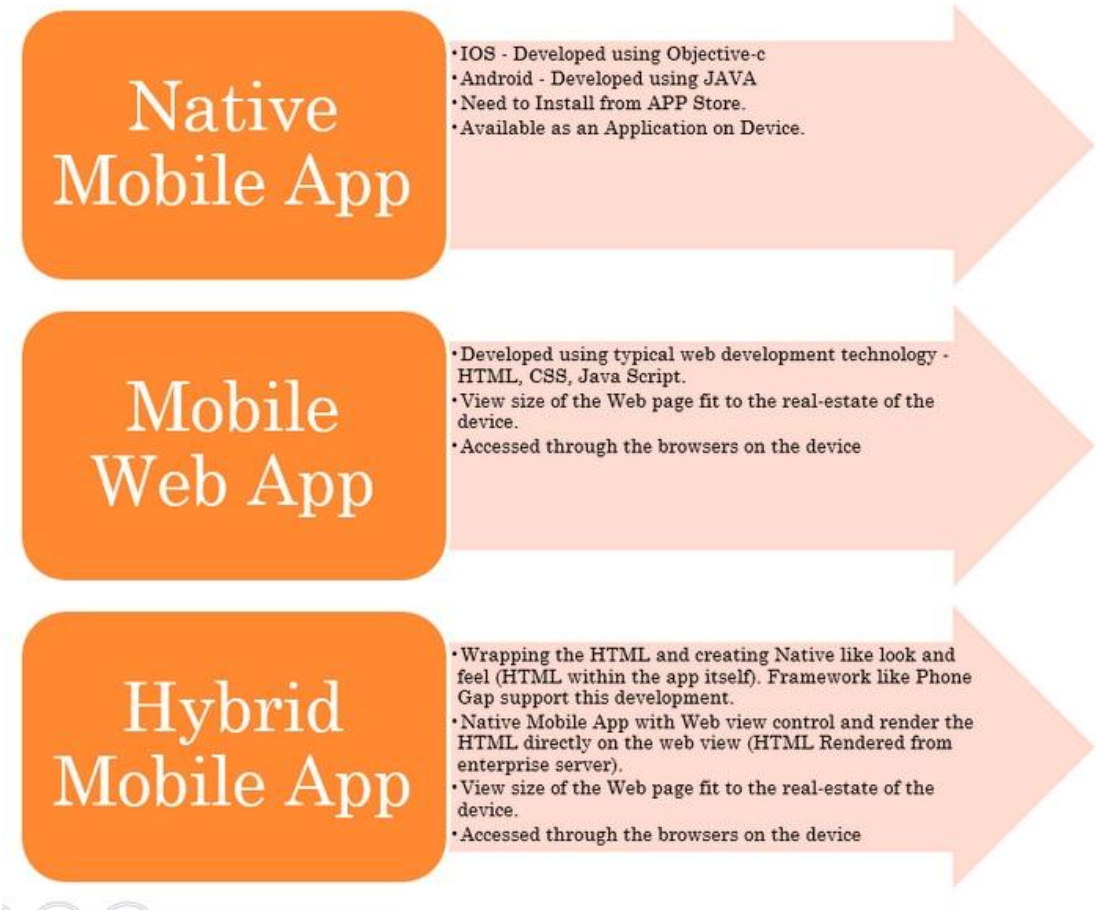

Figure 2-17 Mobile application types (Prasanna, 2013)

The type of application to use is informed by the design and functionality. Design issues concerning the particularities of access devices, communication technologies, and volume of information exchanged are very important in the provision of mobile portal services (Microsoft, 2009). According to a guide by Microsoft (2009) on application architecture, a mobile application will normally be structured as a multilayered application consisting of presentation, business, and data layers. Figure 2-10 illustrates common rich client mobile application architecture with components grouped by areas of concern. According to Microsoft (2009), a mobile application generally contains a user interface (UI), components in the presentation layer and may include presentation logic components. General design considerations include whether to build a thin web client, rich client or rich Internet application; device type to support; consider occasionally connected and limited bandwidth scenarios; design a user interface appropriate for

mobile devices considering platform constraints; design a layered architecture and consider resource constraints (Microsoft, 2009).

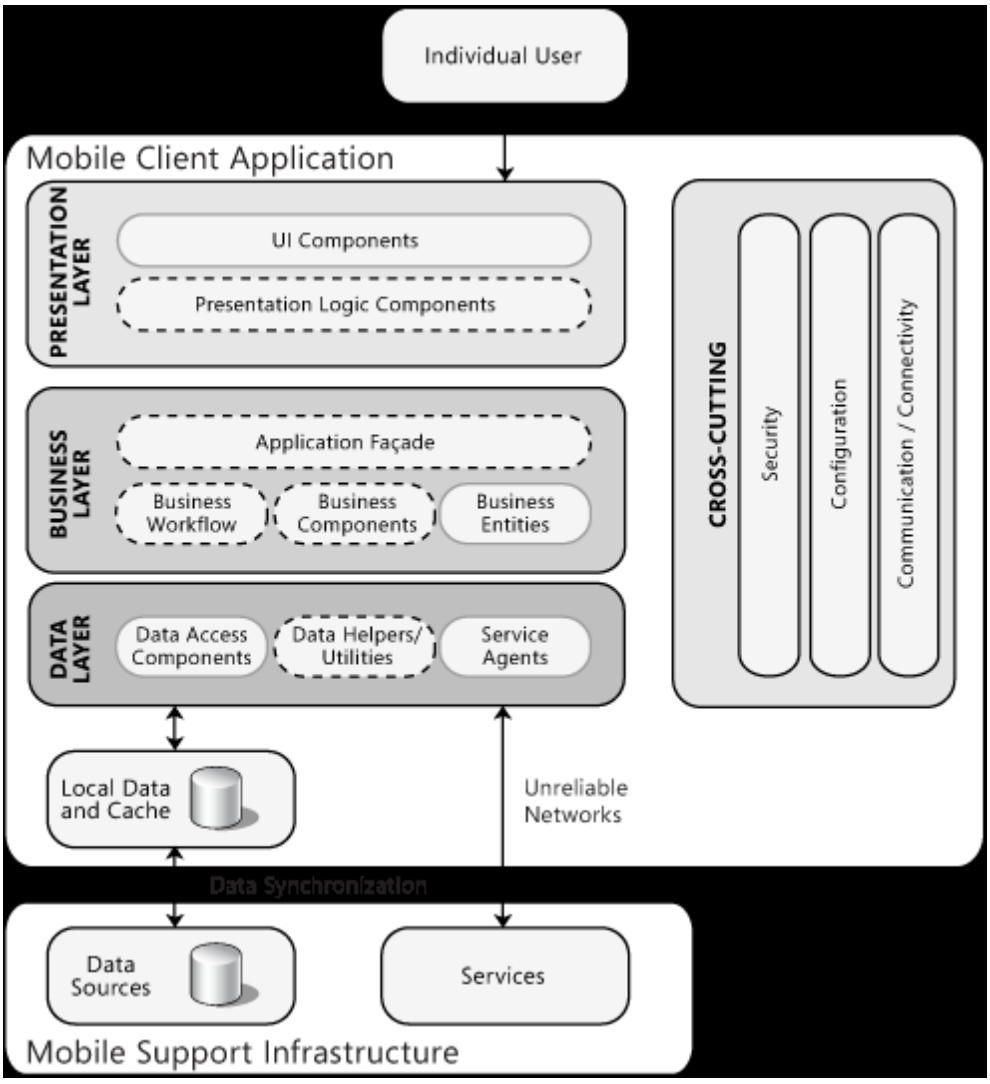

Figure 2-18 Common Rich Client Mobile Application Architecture (Microsoft, 2009)

In figure 2-11 the general architecture of a student information mobile app will be described.

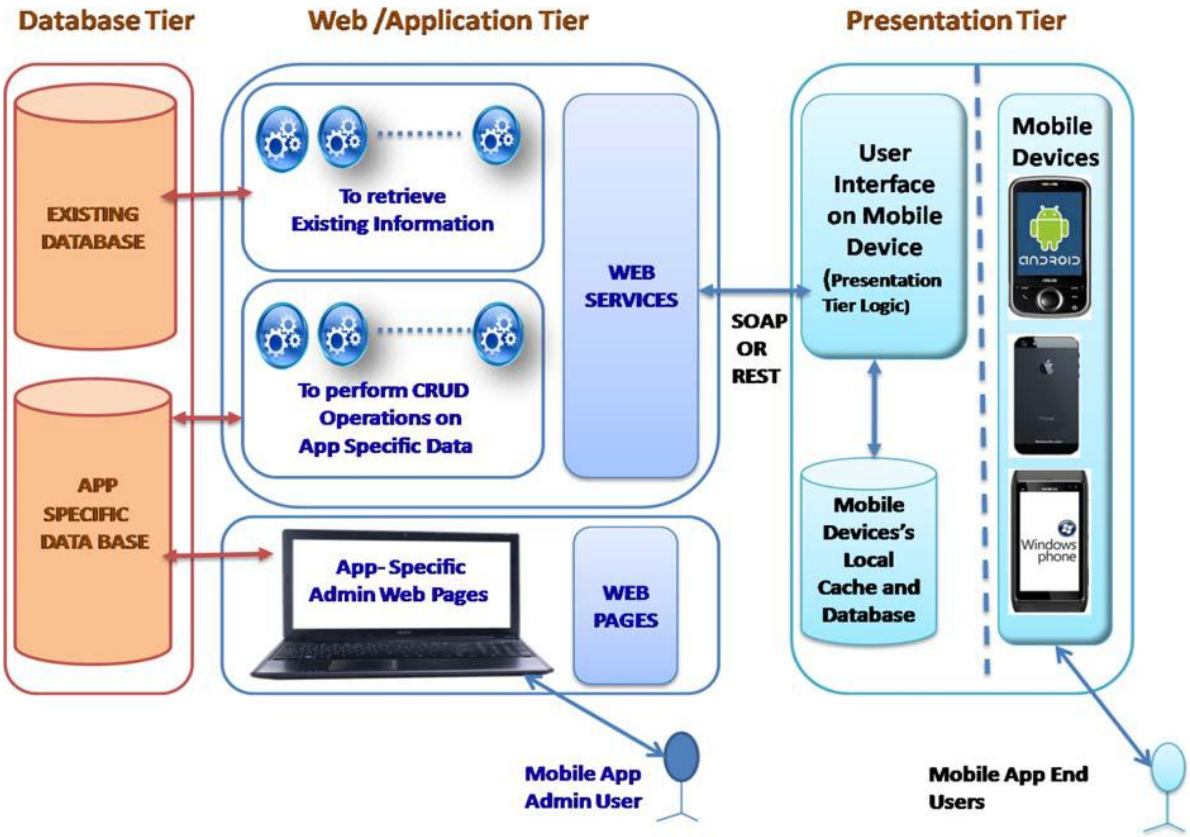

Figure 2-19 Three tier architecture of student information mobile app (Taneja, S. & Goel. A., 2015).

i. Database Tier

This tier is composed of two data stores. One is the existing database of educational institution from which student, related information is fetched. For purposes of this study the data contained in the database include HIV related information from AIDS.gov and other website resources. Only retrieval of data from the database and no modifications will be performed. A small separate database component is created to add some app-specific data such as list of registered users of the app, records of external links to web pages etc. Create, Read, Update and Delete (CRUD) operations are performed on this database as this is specific to the mobile app.

ii. Web/Application Tier

Web services and admin web pages for mobile app in this tier are developed. Web services are broadly categorized into two groups. First group includes the services that fetch the personalized information of student from database based on student's unique id such as

enrolment number. These services do not perform any create/update/delete operations and perform only read operations on existing database of the institution. These services send individualized data to presentation layer in XML/JSON format. Second group of web services performs CRUD operations on app specific data store. They transfer data to and from, from mobile app to data store using XML/JSON. Additionally, admin web pages are created in this layer, which are accessed by the College Admin Department. Using these pages, college admin department manages the configuration of various components of application. Figure 2-12 shows the student information architecture in detail for which the different components are described.

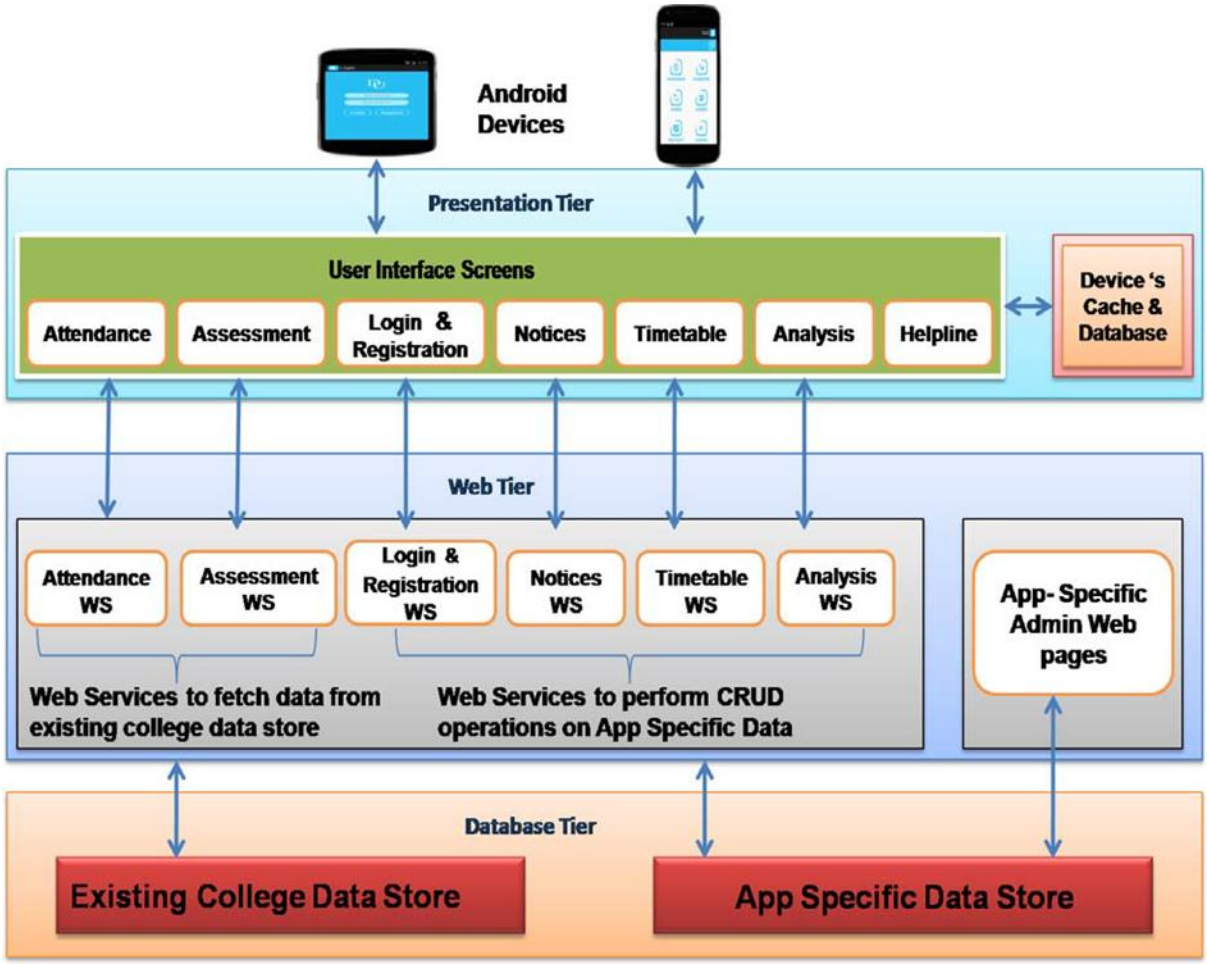

Figure 2-20 Architecture Design of DUIT (Delhi University Information Tool). (Taneja, S. & Goel. A., 2015)

iii. Presentation Tier-The Presentation tier has a cross platform for mobile devices, on which the application is deployed.

For each component there are distinct user interface screens which interact with web services to retrieve data from the college database as in Figure 2-12. A brief description of each component is as follows:

iv. Login and Registration- New user registers first by entering the roll number, email id and password.

v. Attendance- Student clicks on Attendance icon on main screen to view classes attended and classes held for each subject.

vi. Assessment- Personalized student window

vii. Helpline- call on click feauture for asssiting students with queries.

viii. Notices- diplayed notices are displayed

ix. Analysis- is a self analysis tool for attendance/assesments for students

x. Timetable- student timetable

The proposed application will have modules on information access with regards to HIV information, support for chat interactions through a register window and anti-stigma message tagging.

2.7. Systems appraisal

This section shows a summary of the types of systems that have been used for information propagation. Systems that have been used are voice-based; web based; text based, video and mobile based. The limitations and delimitations of each will be summarised as in Table 2-3.

Table 2-3 Information models (Duanb et.al. 2015)

Information service model	Features	Advantages	limitations
Web Portal	A collection of relevant web sites to form a one stop portal for users	Easy to access, compressive and in-depth information provision	One for all information, No customization. May not be relevant to an individual user's specific information need
Voice-Based Service	Information dissemination through phones or online voice calls.	Interactive communications, easy to understand and individual service	Require human involvement, time consuming and less efficient, costlier
Text (SMS)-Based Service	Disseminating information via Mobile phone texts	Push-based approach, very effective and efficient in sending short and timely messages	Cannot provide comprehensive and in depth information. One for all service. May not be relevant to individual user's specific information needs
Interactive Video Conferencing Service	Information dissemination using online conferencing service	Easy to understand, very effective communications, interactive service	Require human involvement can be time consuming and less efficient, costs are high due to the involvement of human experts
Mobile Internet Based Service	Information dissemination using Mobile Internet service via smart phones	Ubiquitous, cost effective, easy access, can incorporate GPS technology to provide location related service.	Require adequate infrastructure and the use of smart device. Require higher IT skills to use new technologies

From the summary in Table 2-3 mobile Internet based service is the most viable mode of information dissemination which will be adapted for this study. From the many mobile applications that have been developed, the AIDS info and HIV testing and services locator are

more relevant for this study. These applications have been ranked as among the top HIV apps in 2016 (Carey, E & Fields. J., 2016). The AIDS info app provides definitions of all terminologies relating to HIV/AIDS in English and Spanish.

2.7. Conceptual framework

Figure 2-13 is a theoretical framework for the application that includes the inputs and outputs expected from the use of the application. The motivators for behaviour change as regards how individual stigma could be reduced. Motivators will include the Interactive chats, information on HIV and anti-stigma tagging. It is expected that from the use of the application, there is improved ARV intake, more HIV testing and generally improved HIV care.

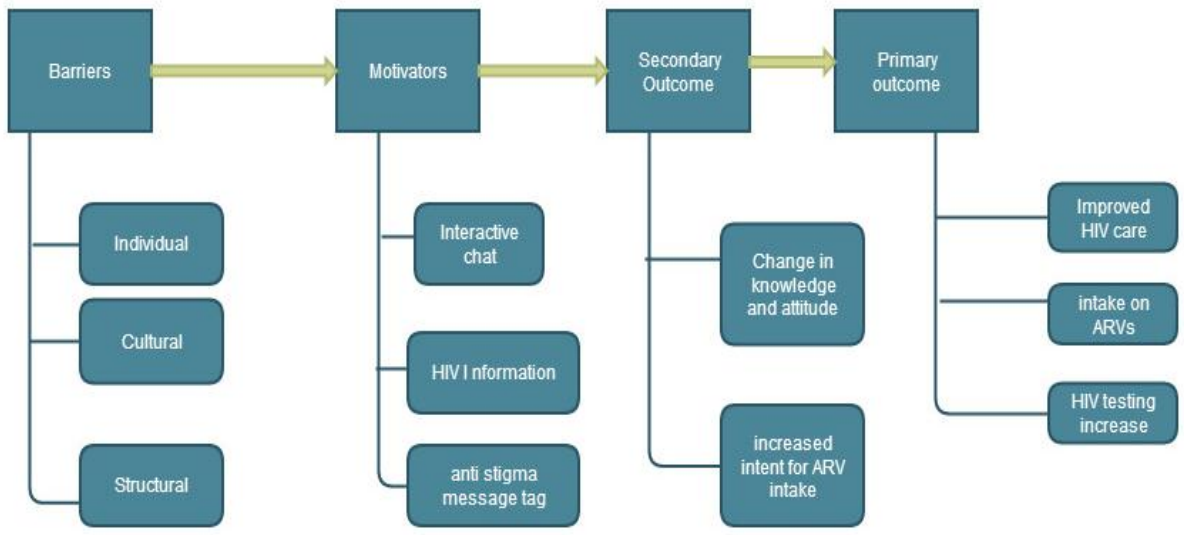

Figure 2-21 Theoretical Framework Adapted from Lee et al 2014

From the theoretical framework, a conceptual framework is derived. The users will be able to access information on HIV, chat support and tagging of anti-stigma messages. Figure 2-14 shows the conceptual framework for the research. A user downloads the application which interacts using the internet. The information is stored in the server where it can be retrieved. The mobile is GPS enabled which will assist in getting coordinates once a user tags a message. The data filter is close to the database to ensure that no offensive messages are sent by the users. The database

will contain offensive messages that are filtered and in case of any new one they are added to the database. This will ensure that there is no offensive language in the chats.

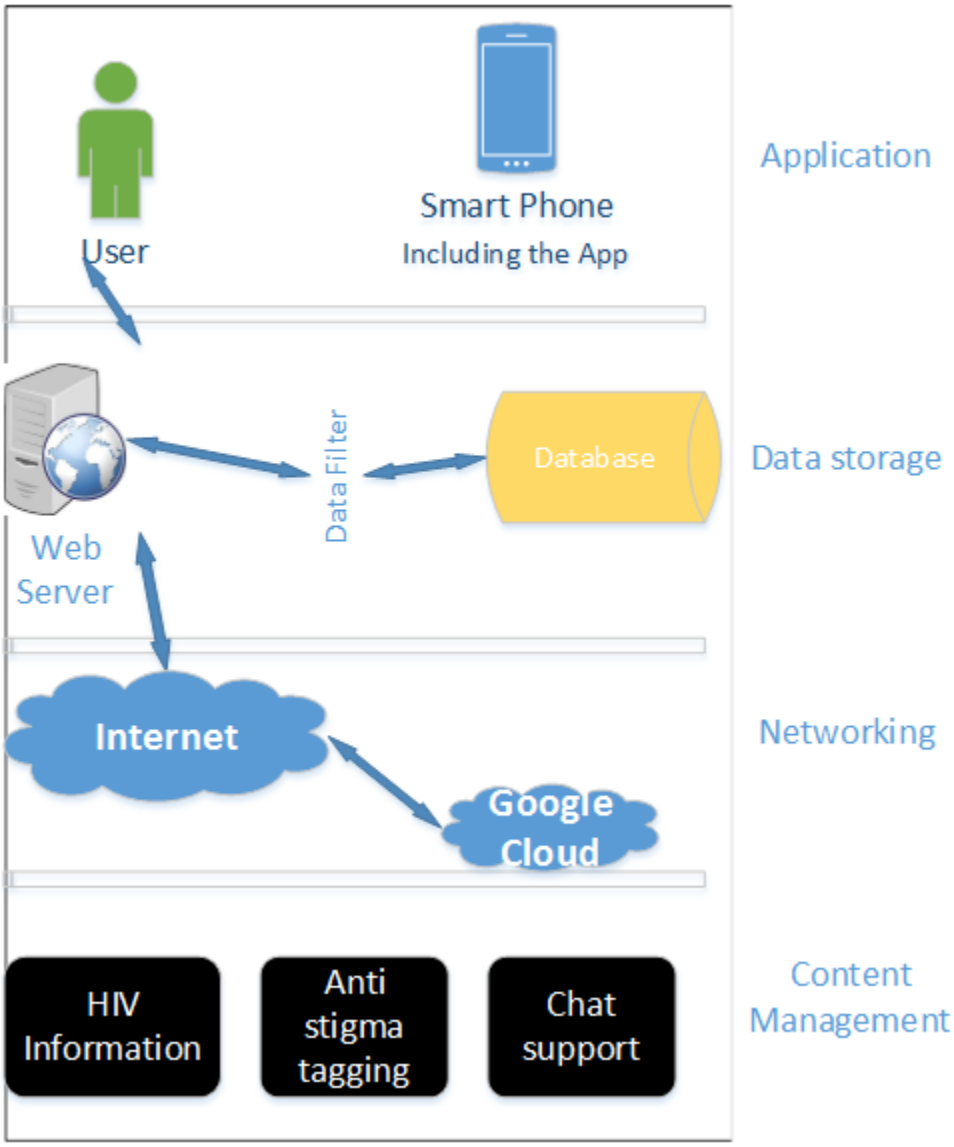

Figure 2-22 Conceptual framework

Chapter 3 Research Methodology

3.1. Introduction

Per Chinnathambi, Philominathan and Rajasekar (2006), research is a logical and systematic search for new and useful information on a topic. It can also be defined as an investigation of finding solutions to scientific and social problems through objective and systematic analysis. Information for research can be found in sources such as books, journals, experience or internet sources. Research methodology is a systematic way of solving a problem for which its aim is to give the work plans of research (Chinnathambi, Philominathan & Rajasekar, 2006). The aim of this chapter is to provide an outline that will be used to guide this research to achieve the research objectives. This is in terms of data collection tools to be used, the research design and analysis of the data.

3.2. Research design

For purposes of this research, a mixed methods approach was used. The concurrent nested design was used for this study. Concurrent nested design seeks information from different levels (Creswell, 2003). The main reason for this is that mixed methods approach incorporates the use of both qualitative and quantitative data. The decision to use this method is informed by the kind of data that was used for this study. Observation as a method of data collection was used for qualitative data collection while questionnaires was used for quantitative data. Among the information sought for include the level of knowledge on HIV related information and experiences of discrimination and stigma. Challenges to service access were identified through documents review. Stigma /discrimination drivers, triggers and outcomes were identified through document reviewing.

The existing initiatives for information dissemination are evaluated and limitations identified. This was achieved by document reviewing. The system requirements for the proposed system were then defined. The proposed solution was designed which included describing the physical and logical components. This included the hardware and software components. Development and implementation of the proposed system was then carried out. The system was tested using test cases defined in this chapter. The users were expected to use the system to validate its usability and functionality as according to the research objectives.

3.3. Population and Sampling

The target population for this study was Nairobi County. It is estimated that there were 171,510 people living with HIV according to 2015 estimates in Nairobi from a report by the Ministry of health (2016). This statistic was also reported in the Daily Nation newspaper (Mutavi, 2016). This formed the population which formed the bigger part from which a sample was derived. A sample is a representative of the entire population. Random sampling technique was used to avoid bias from the questionnaires. It involves choosing a select group of subject for study from a larger group which is the population. Each member has an equal chance for which the selected group is by chance. The advantage of using simple random sampling is that it is easy to use and it gives an accurate representation of the larger group. Participants for the research process were randomly selected from within Nairobi. To represent the larger group accurately this research used the Yamane's formula to get the sample for use. Yamane's formula

$$n = \frac{N}{1 + N(e)^2}$$

Equation 3-1 Yamane's formula

Where: N = Total population; n = Number of samples; e = Error tolerance

This was used for which the level of confidence was at 95% and the N =171,510, thus the sample size was 38 participants. This was calculated using Yamane's formula.

The study was located within Nairobi County. Nairobi County offers a diverse population which includes the middle, low and the high-income class. It also has a population with diverse literacy levels in terms of mobile phone usage which is the mode of delivery of the proposed solution. This provided the different target populations who have different needs when it comes to sourcing for HIV information. While the different classes may require different information, this study dwelt on providing information to educate, and geo tagging of anti-stigma messages to reduce stigma.

3.4. Data collection instruments

This study used several data collection instruments. The data that was used for this study included information on HIV treatment and prevention, perceptions on support groups, general knowledge on HIV information and stigma /discrimination forms. The data was collected using primary and secondary data collection methods such as observations, document review and questionnaires.

3.4.1. Observation

Observation as a method of data collection has been used in many disciplines over the years. This could be attributed to its ease of use as a data collection method. Observation of the young adults and adults assisted to reveal perceptions regarding stigma and discrimination experienced. Participant observation was used for data collection. Kawulich 2005, defines participant observation as the process enabling researchers to learn about the characteristics of people under study through observing and participating in the activities. Use of observation will provide non-verbal expressions for participants.

3.4.2. Document Review

Stigma and discrimination of people living with HIV/AIDS has been studied over time by different researchers, non-governmental bodies and government institutions. Library search and review of information from the different websites will be reviewed to get a better understanding of the factors affecting access to HIV care. This information offered insight on the research leading to a better solution. Information from local newspapers, magazines, periodicals and journals were reviewed to provide a more holistic view. Documents and literature related to HIV/AIDS stigma, HIV awareness, frameworks and models for mobile applications will be reviewed. Online research for websites concentrated on the ministry of health, non-governmental organizations sites such as UNAIDS and AIDs.gov. This helped to understand what has been done in the study area in terms of the programs, applications in place and other initiatives. The data collected would also identify the various types of stigma and triggers for stigma and discrimination

3.4.3. Questionnaire

The questionnaire was mapped with the list of research questions to ensure the questionnaire sought relevant information that improves the outcome of this research. The questionnaires were

distributed for filling by participants in different age groups with more focus on the young adults and adults. Questionnaires provide respondents with confidentiality which is critical when giving out information regarding the area of study. Questionnaires were used to seek answers on sources of HIV information, challenges to access of HIV services and care. Data on discrimination and stigma experienced captured informed the kind of information to be used for the mobile application.

3.5. Data Analysis

In this study, thematic analysis approach was used. This involves searching for themes that emerge as being important to the description of the phenomenon (Daly, Kellehear, & Gliksman, 1997). A theme is a pattern in the information that at minimum describes and organizes the possible observations and at maximum interprets the possible observations (Boyatzis, 1998). Raw data from the questionnaires was captured in Microsoft Excel and the data analysed. Descriptive statistical methods such as frequency distributions and measures of central tendency were used. The mean was used as a summary statistic. The data was presented using graphs, charts and tables.

An example of data coding and identification of themes is as in Figure 3-1.

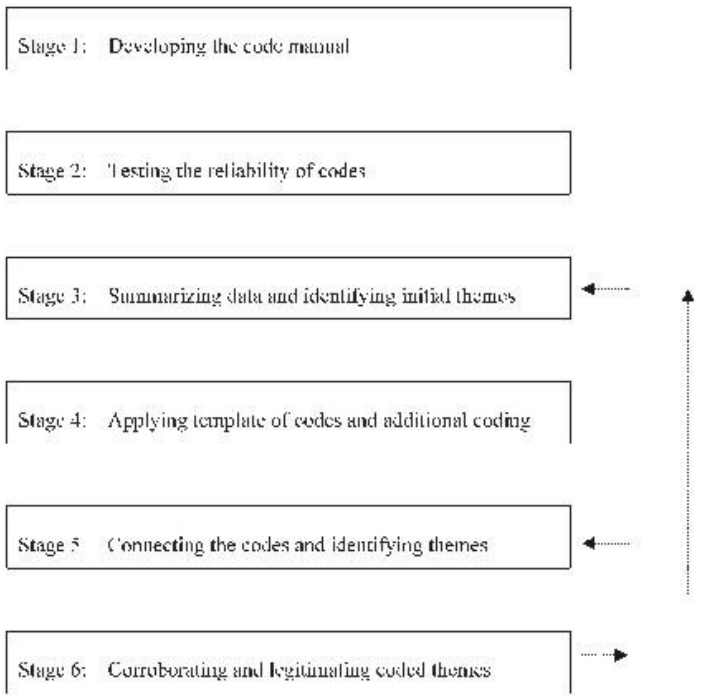

Figure 3-1 Diagrammatic representation of the stages undertaken to code data (Fereday, J., & Muir-Cochrane, E. 2006).

The main analysis clusters included the perceptions to support groups, literacy level of HIV information, attitudes towards PLHIV, level of education and discrimination/stigma perceptions. Data analysed will be presented using tables, pie charts and graphs. These methods were used as they are easy to interpret.

3.6. Research Validity and Reliability

Research validity determines the criteria for how effective the research design will be. This is in terms of the accuracy of the data captured using the collection tools to meet the research objectives. Validity refers to how well a test measures what it is supposed to measure (Phelan & Wren, 2005). Joppe (2000) provides an explanation for validity in research:

…Validity determines whether the research truly measures that which it was intended to measure or how truthful the research results are. In other words, does the research instrument allow you to hit "the bull's eye" of your research object? Researchers generally determine validity by asking a series of questions, and will often look for the answers in the research of others.

Both qualitative and quantitative results of the data collected will be used to determine how well the study has met the objectives. Results from the questionnaires were compared with other statistics from other researches to determine the validity. Phelan and Wren, 2005 propose clearly defining objectives to improve validity and comparing one's measure with other measures. This was achieved by comparing standard questionnaires and the proposed questionnaire on HIV stigma.

Phelan and Wren, 2005 refer to reliability as the degree to which an assessment tool produces stable and consistent results. Joppe (2000) defines reliability as:

…The extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is deemed to be reliable.

Kirk and Miller (1986) go ahead to identify three types of reliability: the degree to which a measurement, given repeatedly, remains the same, the stability of a measurement over time and the similarity of measurements within a given time.

Phelan and Wren propose the use of different test types for reliability such as parallel, inter-rater, internal consistency and test-retest reliability. The test-retest reliability method was used through re-administering the questionnaire to the participants. The results from test 1 were compared with those of test 2 which were then correlated to evaluate the stability of the questionnaire.

3.7. System development Methodology

The software development lifecycle according to Kendall, 2011 was used for the development of the proposed mobile application. It includes several sequential steps that flow as in Figure 3-2.

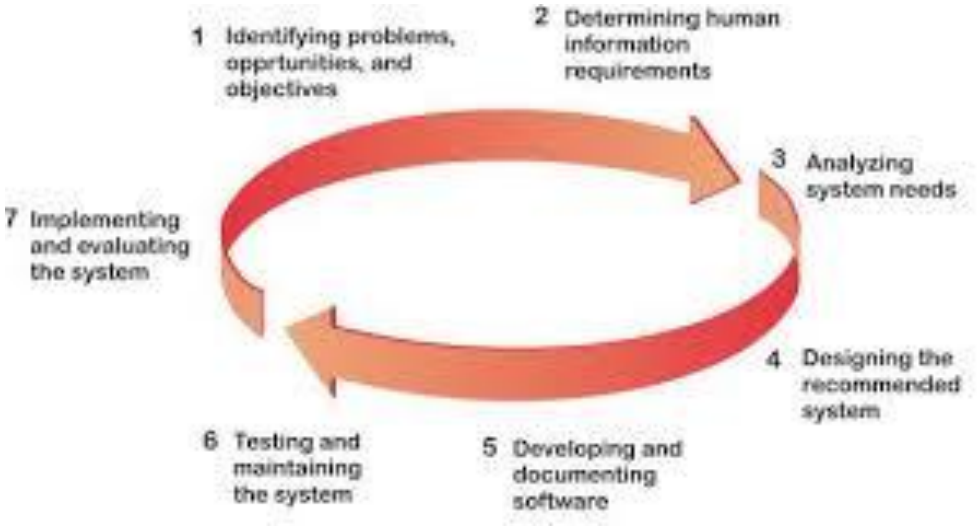

Figure 3-2 software development life cycle (SDLC) (Kendall 2011).

3.7.1. Identifying problems opportunities and objectives

The goal for this phase is to establish the objectives of the proposed application. This was achieved by carrying out document review observation and questionnaires. The questionnaires would give information on the challenges to service access, stigma and discrimination sources. Observation of the target population which includes young adults and adults.

3.7.2. Determine human information requirements

Requirements for the application to be developed are captured and documented in a requirements specification document. The information will be sought from the questionnaires administered to the participants with regards to the information that they may require to be availed to them. This information assisted in the design of the information for the mobile application.

3.7.3. Analysing system needs

This phase focused on the various components that will be involved in the mobile application development. This included the data, processes, people and information. The hardware requirements which include the kind of phone to use were evaluated.

3.7.4. Designing the recommended system

The design of the system was depicted by use of Unified Modelling Language (UML) diagrams which will be illustrated in the next chapter. These included use case diagrams, sequence, data flow diagrams and entity relationship diagrams. These diagrams were of necessity in showing the process, information flow and relationships between the entities in the mobile application.

3.7.5. Developing and documenting software

The system was developed into small programs called modules that were then integrated in the subsequent phases. Each module developed was be tested for functionality. This included checking whether the user requirements have been met as expected.

3.7.6. Testing

All the modules developed were integrated into a system after which testing was done to establish any failures. Kendall 2011 says that it is easier and less costly to identify problems before the system is deployed for use. The testing to be carried out includes: functionality and acceptance tests. Acceptance testing require that the mobile application be used by the target population and feedback sought by use of a usability questionnaire. The different components will be tested for functionality and usability. This was done on the Android environment. Sommerville's model for the testing process was used for this study. Figure 3-2 illustrates the process flow.

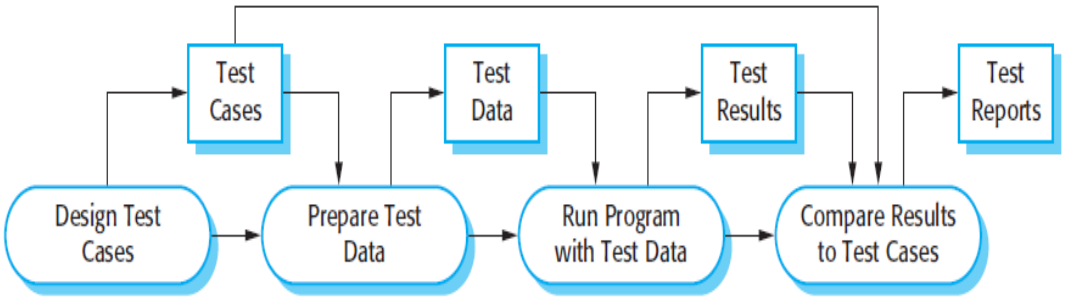

Figure 3-3 Model for testing process (Sommerville, 2011)

The test cases were evaluated on three levels. These levels are unit testing, component and system testing. Unit testing focuses on the functionality of objects or methods (Sommerville, 2011). The defects and expected results for the components are evaluated using the test cases.

Test cases will be expounded in the testing chapter.

A usability test plan will be used for testing purposes. Among the interactions to check:

i. Register a user and login
ii. Start chat session filtering offensive words
iii. View information from the application
iv. Geo-tag message

3.7.7. Implementing and evaluating

This stage involves deployment of the application in the production environment for consumption. After the deployment of the product, there are discrepancies that may arise requiring upgrades or minor fixes which will be addressed. Some of the fixes will include updating the Android application package (APK) to enable a seamless execution of the application.

3.8. Ethics in research

Ethics are the codes or rules that manage the practice of a profession (Creswell, 2003). While collecting data, there are ethical issues that may arise of keeping confidentiality of data in regards to consent, privacy and discrimination and stigmatization of PLHIV. Confidentiality and privacy of data collected will be ensured by only using the data for this research only. Data collected through the questionnaires was done voluntarily without force or coercion. The below five principles are applied for research to steer clear of ethical dilemmas per Smith, (2003).

i. To be conscious on multiple roles by avoiding relationships that would impair one's professional performance.
ii. To follow informed consent rules to ensure participants are participating voluntarily and are fully aware of the benefits and risks.
iii. To uphold individual rights by respecting individuals' confidentiality and privacy.
iv. To discuss intellectual property frankly to inform who should get credit for the work.

v. To tap into ethics resources by knowing what one's ethical obligations are.

Chapter 4 : System Design and Architecture

4.1. Introduction

System design is a process that defines the data, components and interfaces that make a system. This allows one to know what the system will do, look to the user and that it meets the requirements. As per Microsoft 2009, software architecture is the process of defining a solution that meets the requirements while making se of attribute such as performance and manageability. As per the software engineering institute (SEI), software architecture is the blueprint of a system which defines what is to be done in terms of responsibilities and objects. The responsibilities define the relationships between the objects and their interactions. The architecture assist one to understand how a system will work. The architecture informs how acceptable the system will be. The requirements will be actualized using the data acquired from questionnaires for which the results will be discussed. To get a feel the blueprint of the system, Unified Modelling Language (UML) diagrams will be discussed in the following sub section.

4.1.1. Age

The researcher sought to use the data to find out the experiences of the young adults on matters HIV as most of the young were the most affected with new HIV infections. Most of the participants were aged below 46years as from Figure 4-1 which includes the young adults.

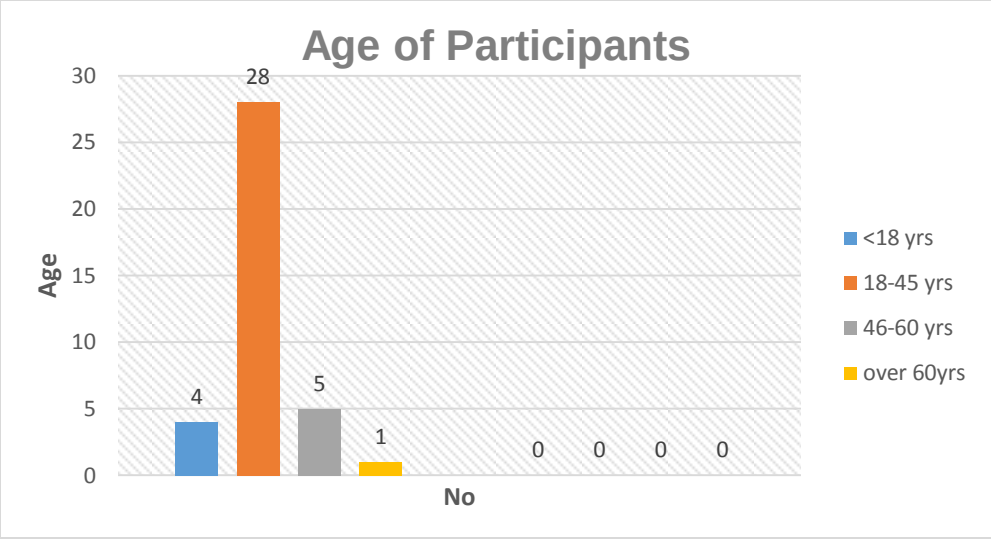

Figure 4-1 Age of Participants

4.1.2. Gender

The gender of the participants was used as a data element to verify whether females were more receptive as was initially thought. In most support groups, there were more females participating as opposed to men. The female participants were equally receptive as their male counterparts as in the Figure 4-2. This helped to reduce bias towards a gender.

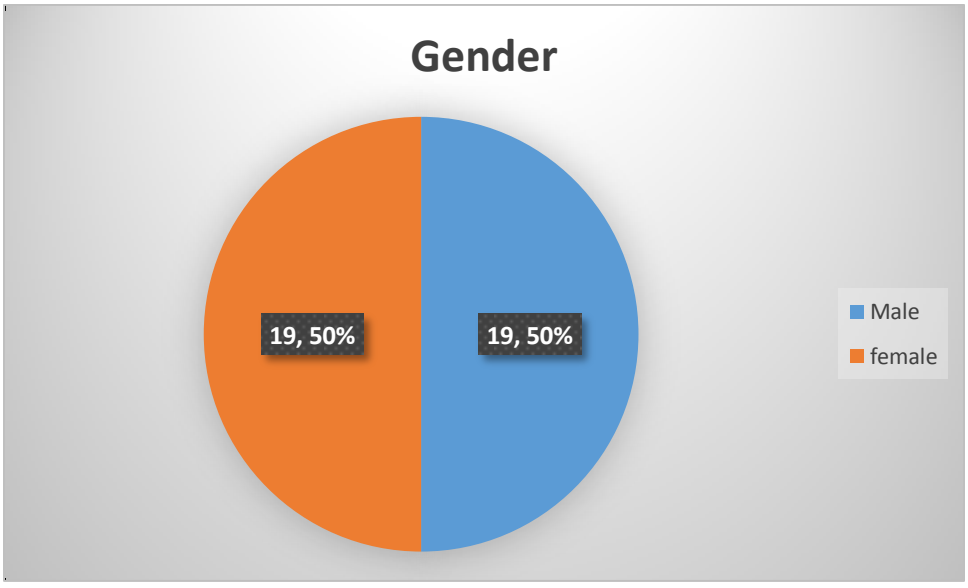

Figure 4-2 Gender of participants

4.1.3. Education level

The education was an important data item used to check the relation between literacy levels and the level of education. Most of the respondents had gone through form four with most having attended college. This may have affected the responses on HIV information knowledge which showed participants having the correct information. This showed that the level of education had little or no significance to one's literacy levels on matters HIV information and stigma and discrimination of PLHIV.

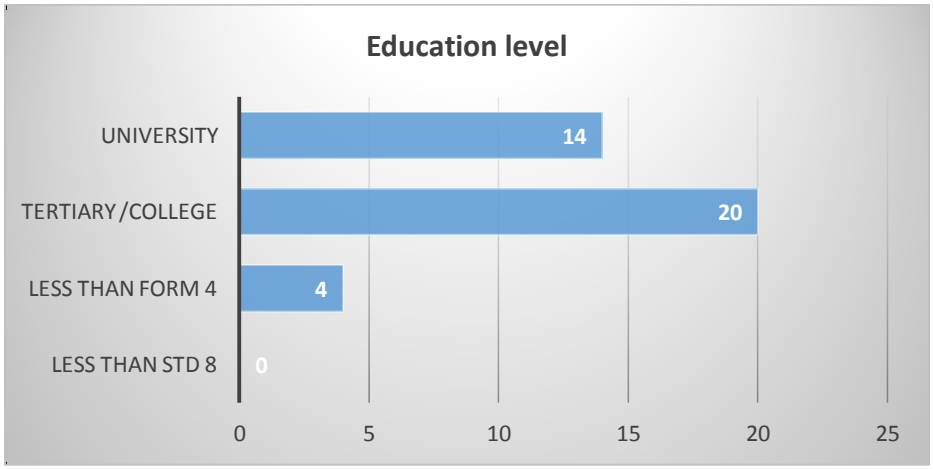

Figure 4-3 Education level

4.1.4. Disclosure

Out of the 38 respondents, at least 31(82%) knew their HIV status while only 7 (18%) did not know of their statuses. Most of the respondents had known of their status for at least 2-5 years. Disclosure of one's status is determined by one's marital status as from the participants' feedback. Most of the married participants had disclosed their status to their spouses while those that are not married were not likely to disclose their statuses. Out of the 15(65%) married participants, 8(35%) had disclosed their status to their spouses.

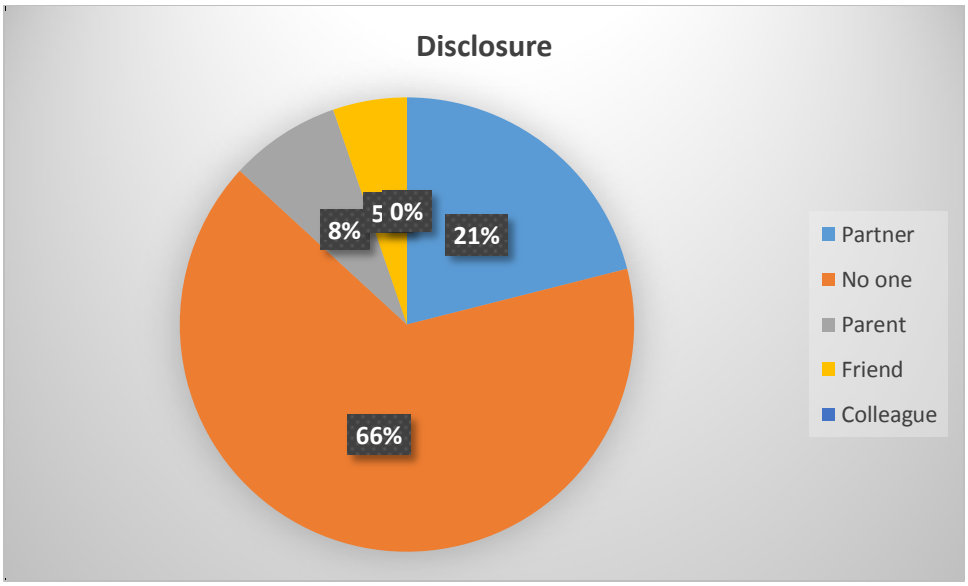

Figure 4-4 Status disclosure

4.1.5. Literacy level on HIV related information

Level of literacy on HIV information was initially assumed to affect the stigma levels with lower literacy being associated with high stigma levels. This question sought to find out whether there was a relation between literacy levels and attitudes towards PLHIV with regards to care. General HIV information is well known as most of the respondents show. Out of the 38 responses to questions 1-7 none was wrong with a clear misinformation about spread of HIV by mosquitos. Out of the 38 respondents 25 responded positively for question on spread of HIV by mosquitoes. This means that 66% of the respondents thought that HIV is spread through a mosquito bite while only 34% thought otherwise. HIV is not spread by a bite from mosquitoes. Clearly there is a misconception about some modes of HIV transmission. The high literacy levels may be attributed to one's level of education. The higher the education level the higher the literacy level. From respondents' feedback, at least 90% had college to university education. Despite the high literacy levels, there is still fear of interacting with PLHIV from Figure 4-9. This fear drives the stigma and discrimination for PLHIV.

4.1.6. Support group perceptions

Support groups are good places to go for support and interacting with people of the same condition. The questionnaire sought to seek whether there was a relation between support group attendance and what prevents people from attending such. Most participants seemed to not know

of any support groups as in the Figure 4-5. 75% of the participants did not know of any support groups where they lived. This is to show that when a more accessible medium is used more people would love the idea of support groups. Transportation to support groups was not an issue as there was no positive feedback. Refusal to join a support group by spouse or parents and not liking support groups was seen not to affect participants' decision to join a support group.

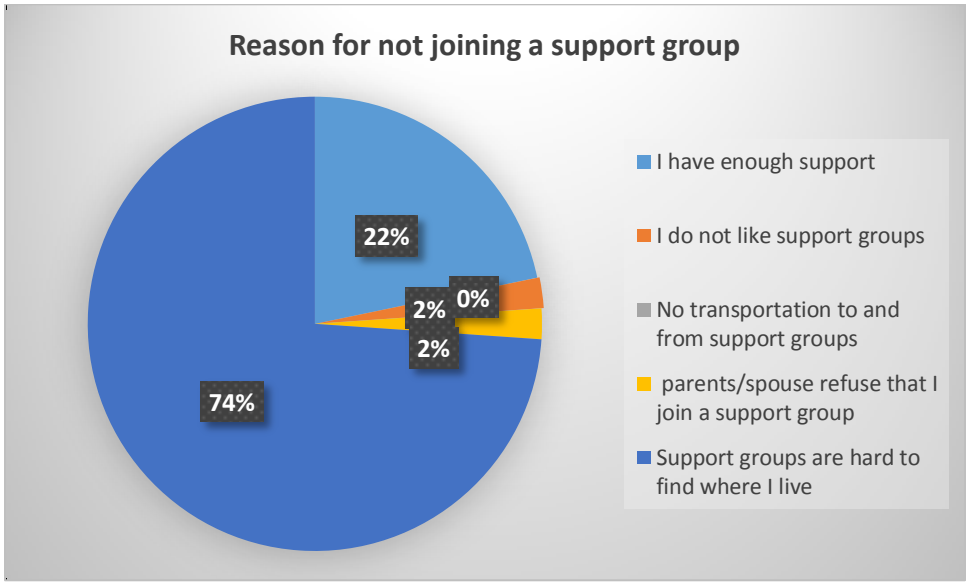

Figure 4-5 Reason for not joining support group

Support groups are perceived differently with regards to how important they are. Most participants believed support groups are for those seeking love and acceptance. None of the participants believed support groups are of no use. A considerable percentage perceived support groups to be for people not able to cope with their HIV status.

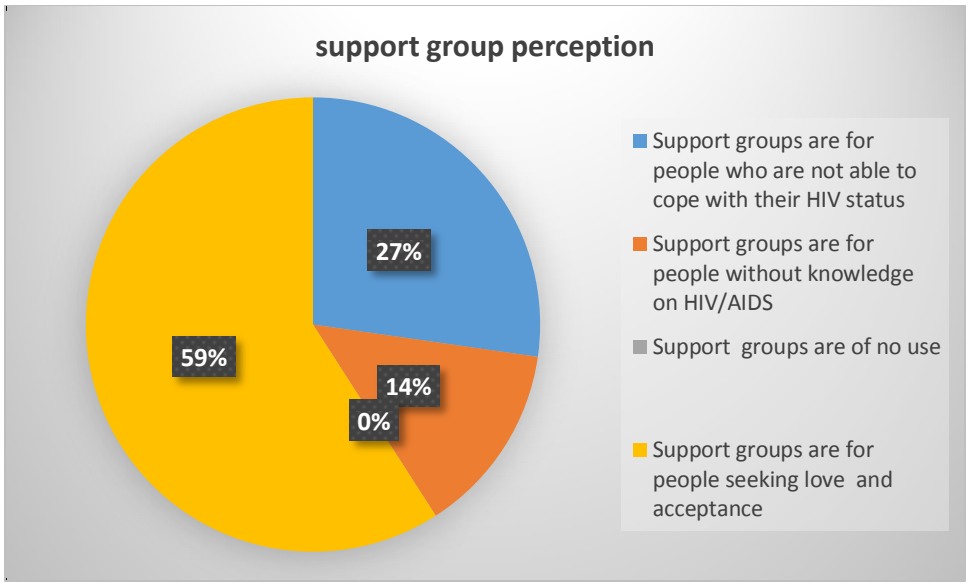

Figure 4-6 Support group perception

Most participants seemed to prefer groups that are facilitated by a PLHIV as opposed to a professional facilitator. The size of a support group affects participation as more participants preferred small sized groups that are not necessarily separated into male and female.

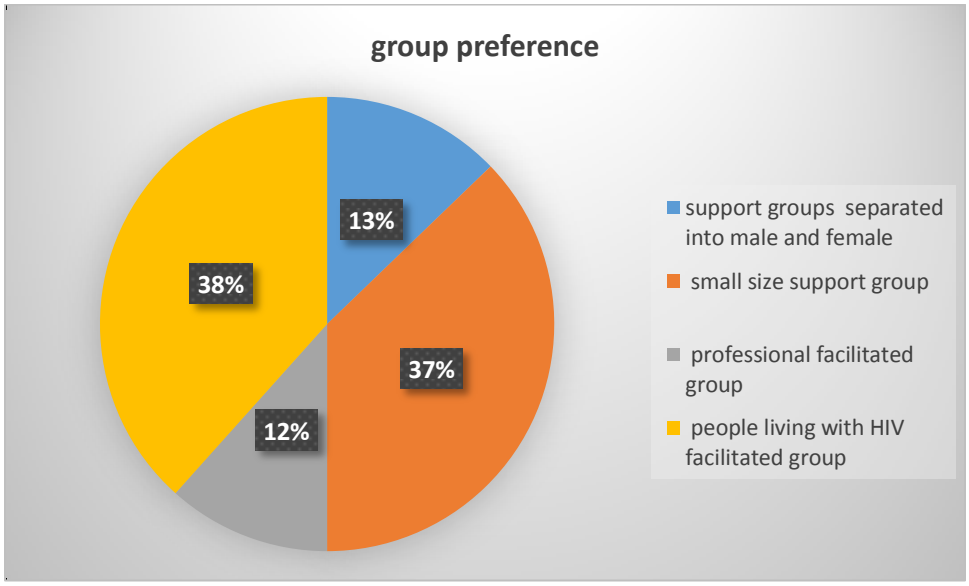

Figure 4-7 Support group preference

Support group attendance has been hampered by reasons such as no knowledge of support groups and their existence. From participant's feedback, only a few have attended support groups

with the larger number having not attended any support group. Existing stigma and discrimination may be a reason as to why support group attendance is not so common. This is evident from Figure 4-6 where 59% of the responses believe that support groups are for people seeking love and acceptance.

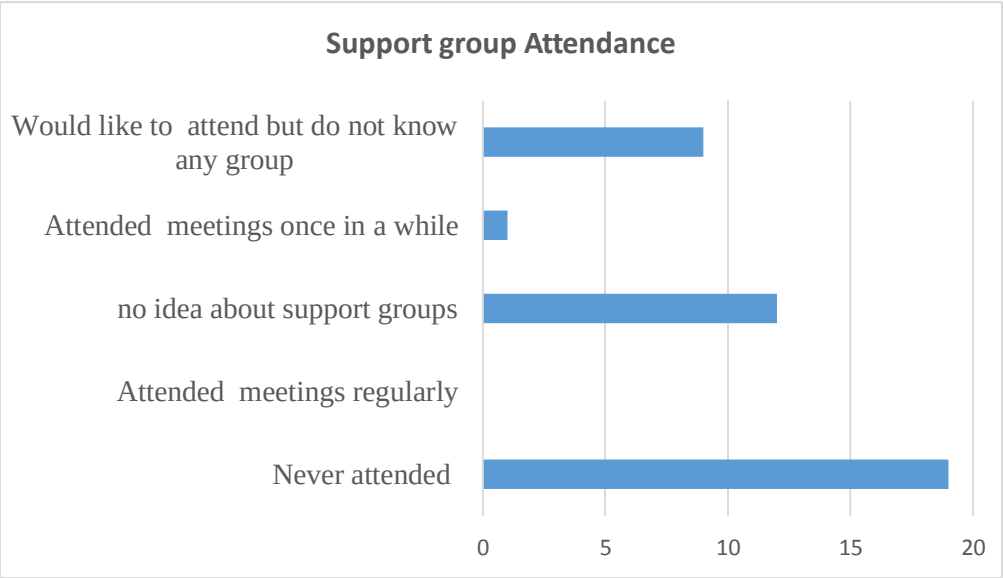

Figure 4-8 Support group attendance

4.1.7. Attitudes towards PLHIV

Attitudes towards PLHIV expound on areas that PLHIV are discriminated against. PLHIV have been discriminated over time due to various reasons. The question sought to find out how PLHIV are perceived by having respondents answer the questions as in table 4-1.

Table 4-1 Attitudes towards PLHIV questions

If one of your relative, who is HIV positive, becomes ill, would you be willing to care for her/him in your house or community?	Q1
If your friend is HIV positive, would you continue your friendship with him/her?	Q2
If a shopkeeper or food seller is HIV positive, would you buy items from him/her?	Q3
If a student is HIV positive, she/he should be allowed to continue his/her study in school?	Q4

If a teacher is HIV positive, she/he should be allowed to continue his/her teaching in school?	Q5
Have you ever experienced any discrimination at the workplace?	Q6

The perception of PLHIV as is in the above items shows that there are levels of discrimination in the various sections. From participants' feedback, out of 38 respondents 34 (89%) would be willing to take care of a PLHIV. 32 (84%) respondents would be willing to continue their friendship with a PLHIV. Most respondents would not be willing to take food prepared by a PLHIV as out of 38 respondents only 11 responded positively. This means only 29% would take food that was prepared by a PLHIV. This shows a level of misinformation and fear associated with PLHIV with regards to handling food. At least 92% of the participants agreed that a teacher who has HIV should be allowed to continue teaching. From the feedback, some participants have experienced instances of discrimination which is a barrier to service access. As observed, discrimination existed but there was fear to disclose this which could be attributed to the fear of disclosure of one's status.

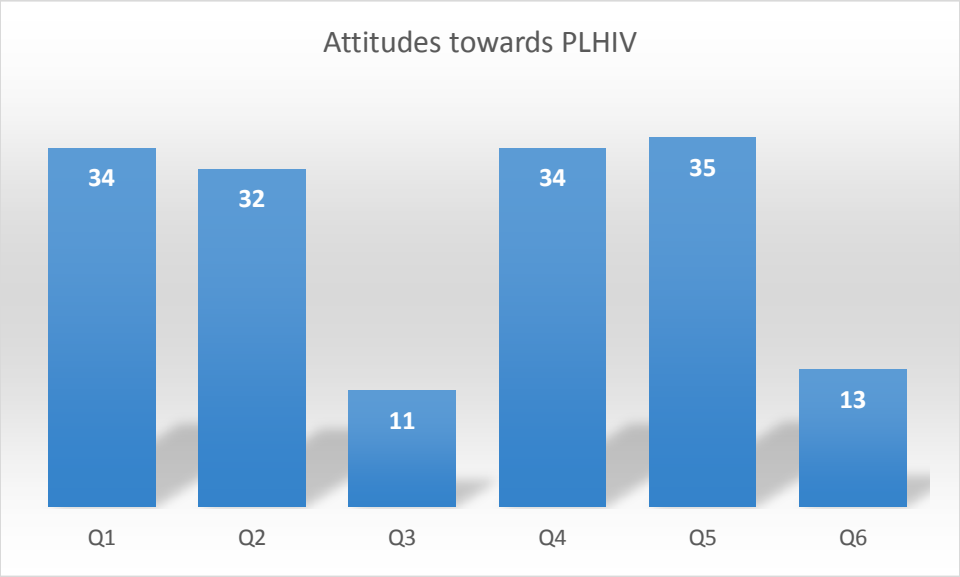

Figure 4-9 Attitudes towards PLHIV

4.1.8. Mobile Operating system

This question was used to enable the researcher find out the whether the intended platform for use would be the most viable option. Most of the participants had access to mobile

phones. From the Figure 4-10 most respondents owned mobile phones that had the Android operating system which is the platform for the application. This makes it convenient for piloting of the application.

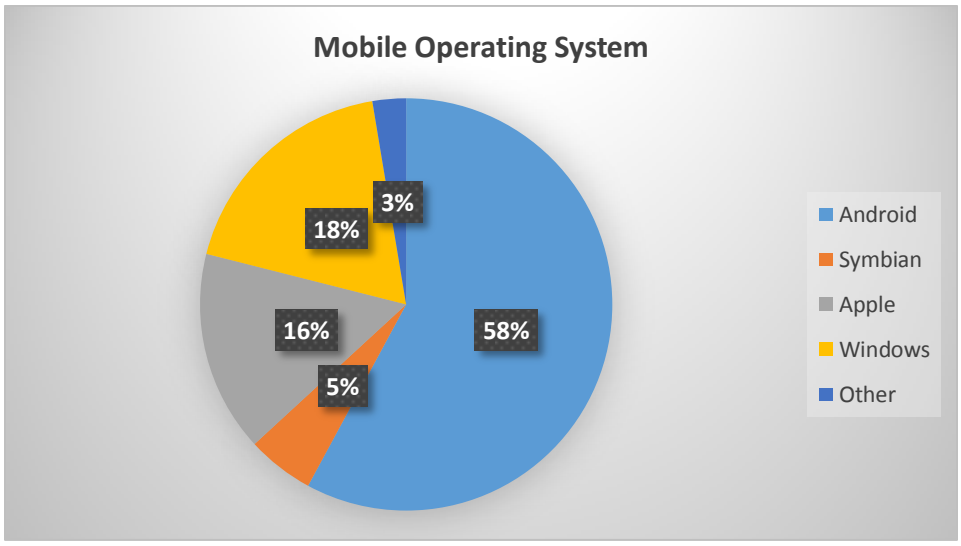

Figure 4-10 Mobile Operating System

4.1.9. Other Findings

From the questionnaires, there are themes that are evident relating to HIV stigma as in Figure 4-11. The factors driving each subset are shown by the direction of the arrow. Factors that affect participants' attitudes towards PLHIV include: care, contact and associations. Associations include working together, going to school and being in the same environment as a PLHIV. Taking care of a PLHIV influence how one perceive HIV. This is due to the perception that caring for a PLHIV is a tedious work and at times exhausting with the fear that one can contract HIV. Attending support groups also fuel HIV stigma as when one attends a support group the perceptions are that one looking for love, information and a sense of belonging. It is perceived that most people that are not able to deal with their situation are the ones who are supposed to join support groups. Many participants seem to consider not to disclose their status as once one discloses their status, there is a high likelihood that they will experience instances of discrimination and detachment from. Forms of detachment include losing friends and not being included in social functions and gatherings.

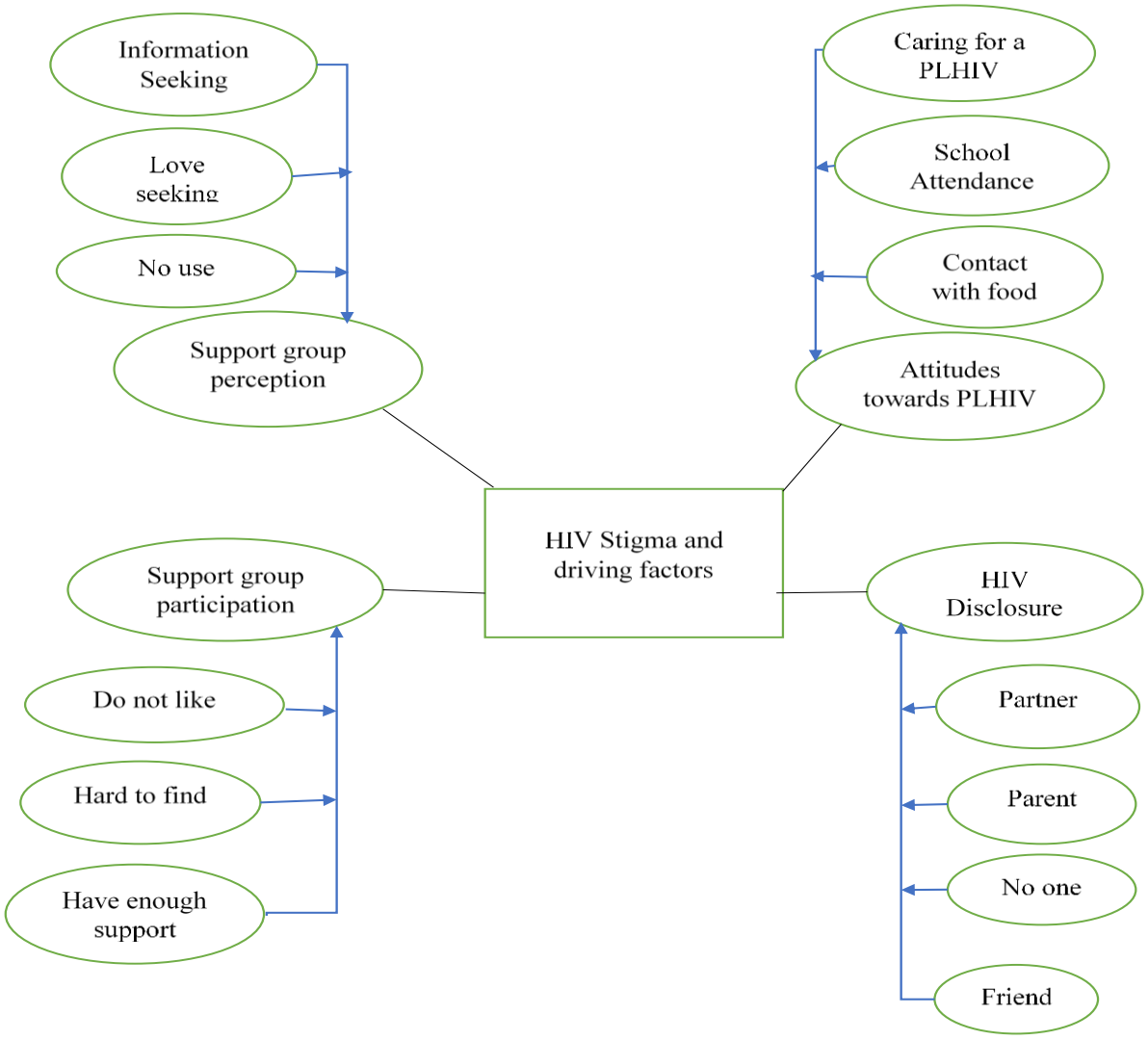

Figure 4-11 HIV stigma driving factors analysis

The decision to participate in support groups is determined by whether one has enough support, access to a group and their personal perception of a group in terms of like or dislike. A person's perception of a support group informs their decision to join a support group and further fuels HIV stigma. A perception may be as a result of one's age and experiences with PLHIV. Support groups were perceived as being for people needing love, information on HIV or being of no use.

4.2. System Design

The Unified Modelling Language (UML) diagrams will be used that represent the various interactions of the application are expounded. The diagrams are; use case, system sequence,

entity relationship and data flow diagram. Each diagram is followed by an explicit explanation on the flow of information in the application.

4.2.1. Data Flow Diagram

The diagram shows the flow of processes and activities throughout the application. The arrows pointing to the various objects show the interactions and relationships between the entities. The interactions for the administrator, user and facilitator are the main interactions of the application. A user in this case may be one who is registered or not registered. An Administrator updates information in the application such as new HIV information and offensive words to be filtered. The user can start a chat, view information on HIV treatment and prevention. They are also able to tag anti stigma messages which are pre-established with an option of creating new messages for tagging. The facilitator and professional are able to give feedback on questions asked by the users.

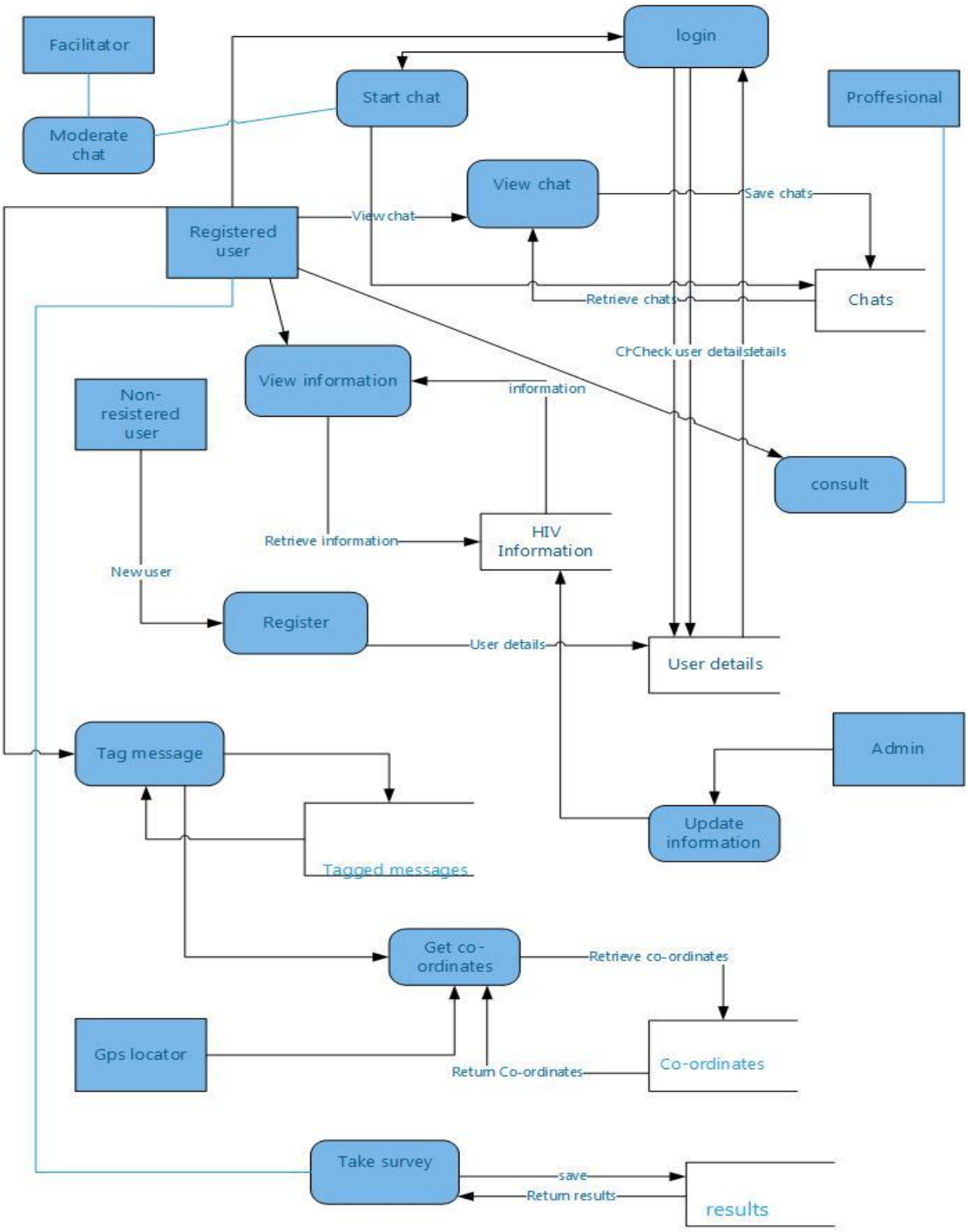

Figure 4-12 Data Flow Diagram

4.2.2. Use Case Diagram

The use case diagram describes the various actors and the processes that are involved in the application. The primary actors are the mobile app user, administrator and facilitator. The GPS locator is a secondary user that makes it possible for a user to geo-tag an anti-stigma message. From the interactions, each actor is associated with at least one use case with others having more than one use cases and multiple actors being associated with only use case. As follows is a description of the chat use case:

i. User registers in the application
ii. System records user details
iii. User logins to the application
iv. User starts a new chat session
v. System records session details
vi. User logs out

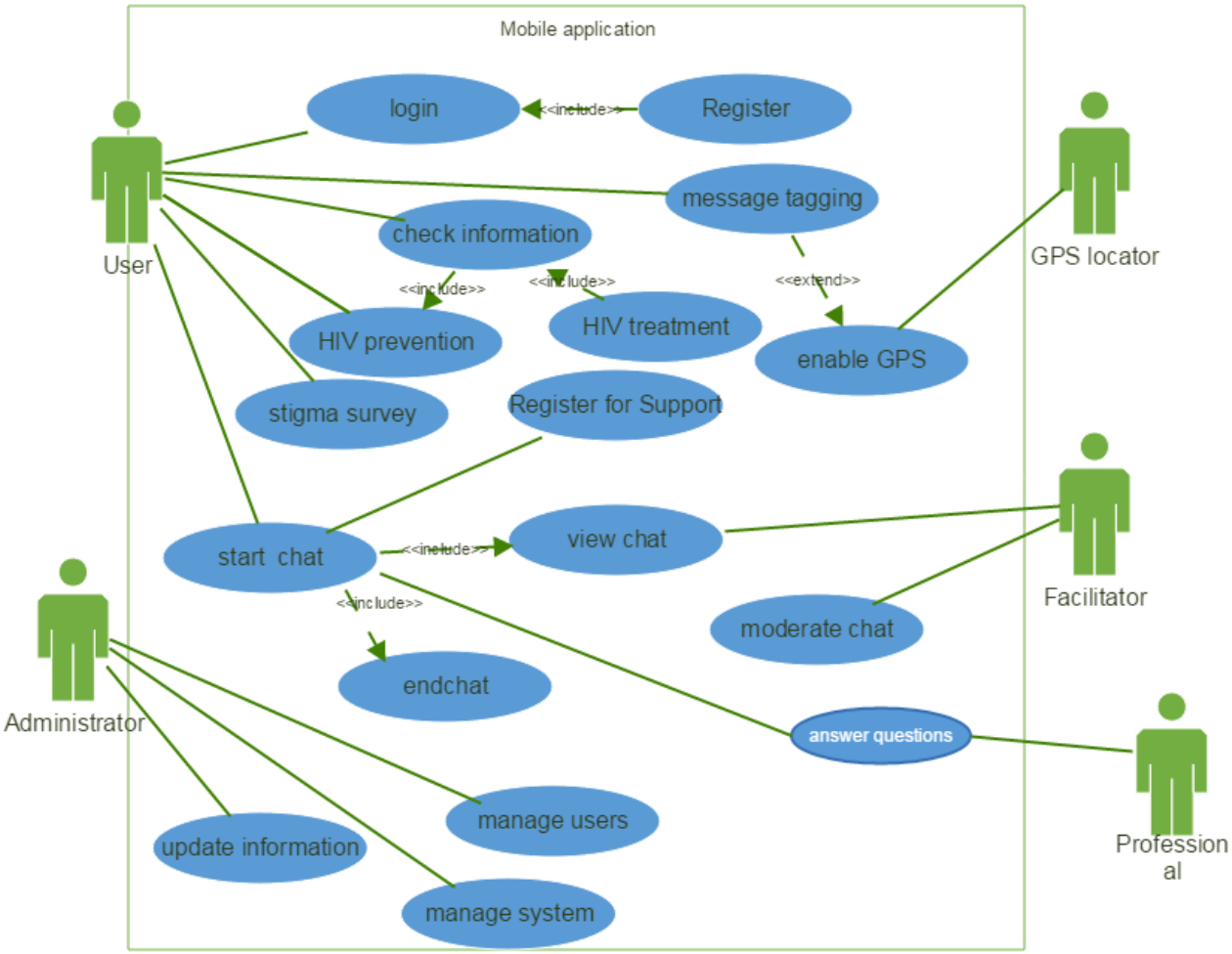

Figure 4-13 Use case

4.2.3. Entity Relationship Diagram

This diagram illustrates the relationship between the people, objects and events within the application. It also shows the attributes for each entity which have their associated data types. A user has a name, password, unique id that is the primary key to enable easy data access and normalization.

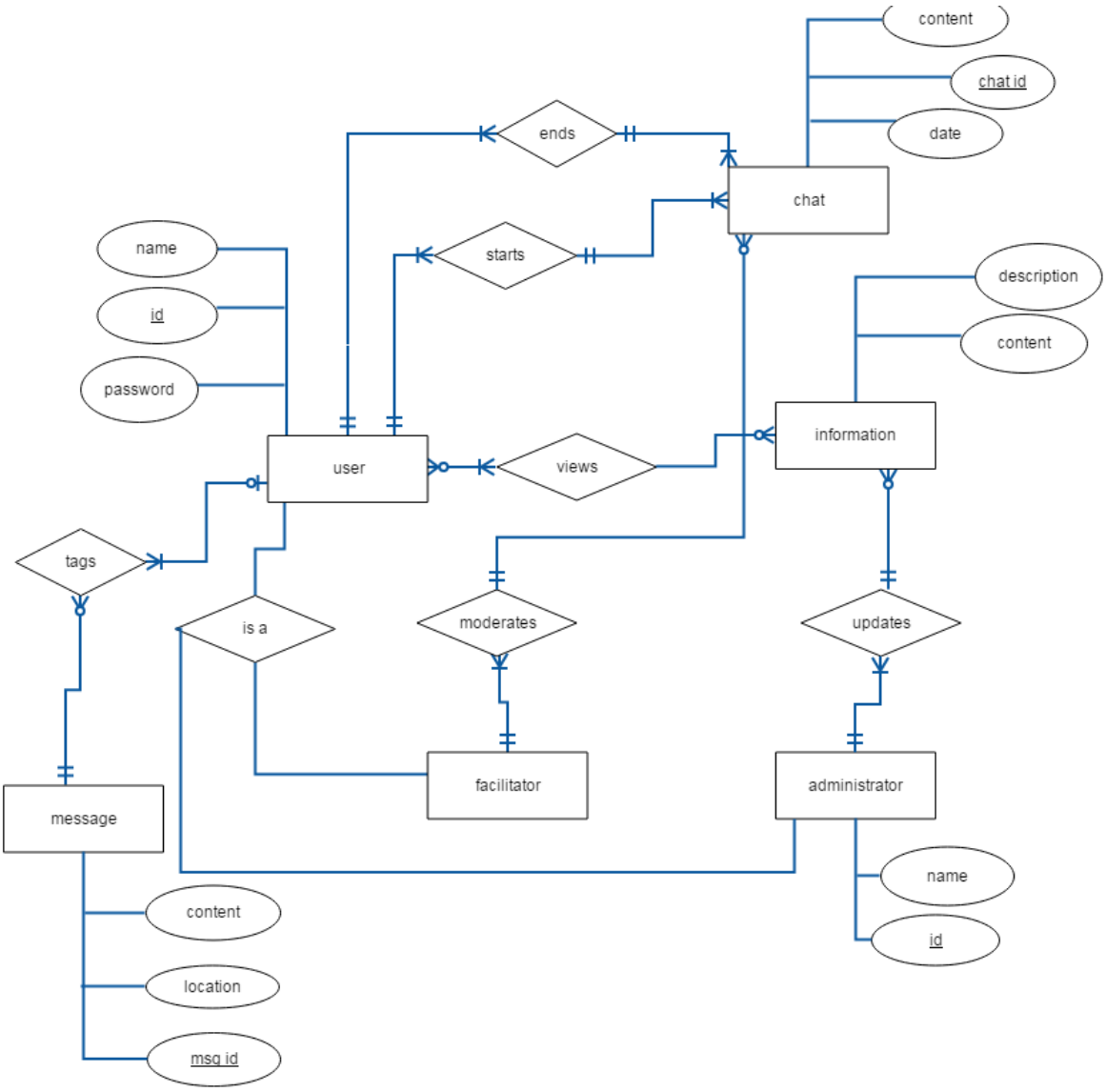

Figure 4-14 Entity Relationship Diagram

4.2.4. Sequence Diagram

The diagram shows the interaction of the processes with one another and in what order this happens. The interactions in the diagram allow for one to understand how the application works in the different sub modules. The vertical lines indicate the interactions and the horizontal arrows describe the messages that are exchanged between the processes.

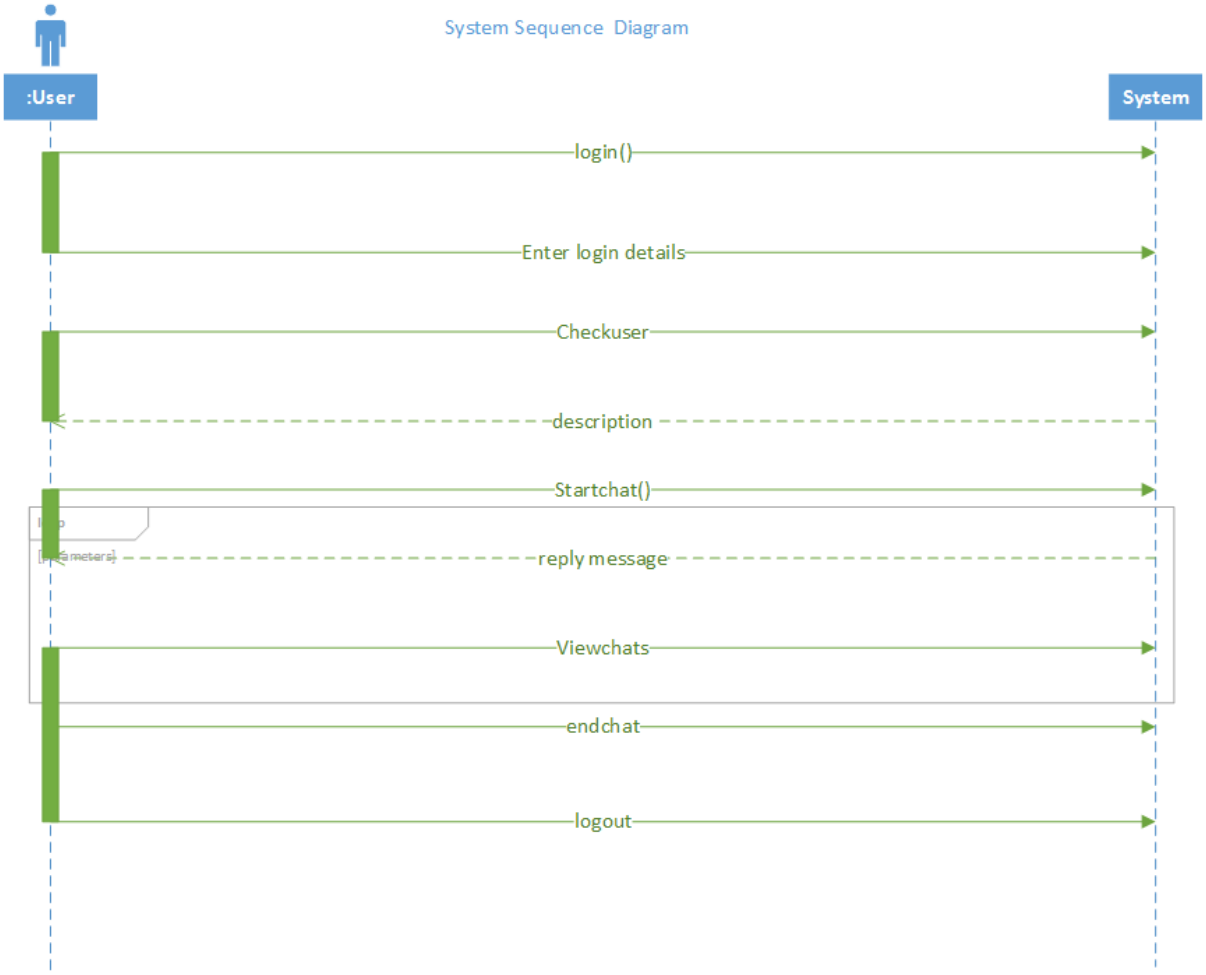

Figure 4-15 System Sequence Diagram

4.3. System Architecture

The overall architecture is composed of two main components: server end and client. The server end is where data is stored and retrieved from. This includes the HIV information, tagged messages and user details. The client end is where the user accesses the application and can access the education module which is in the form of HIV information on treatment and prevention. The self-support module assists a user to start chats with another user preferably a PLHIV as from feedback on data collected. Anti-stigma tags tell others it is not right to stigmatize a PLHIV. This creates a sense of association for others using the application even if not infected by HIV. A user identifies with others by seeing that there are others with HIV and are against HIV stigma. The mobile application is running on the Android platform.

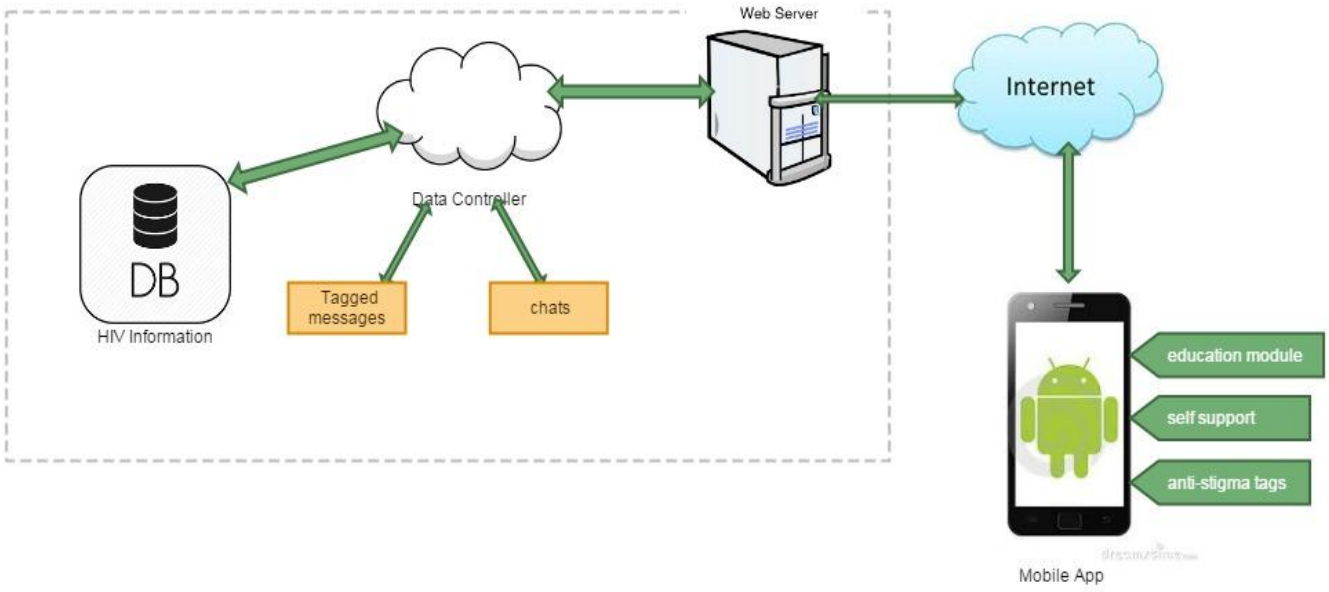

Figure 4-16 System Architecture

4.4. Functional Requirements

The application can: allow input of data from user chats. Provide a friendly user interface for input of data and viewing. This is to enable the interaction to be easy and friendly from the user perspective. Show data stored in the database by enabling the user to retrieve and view older chats. Enable the facilitator in this case another PLHIV to view and manage chats by the users. Allow a PLHIV seek professional support through interactions with a professional. Allow the administrator to update content on HIV information which will give the user a more current version of the information.

4.5. Non Functional Requirements

The application is designed to allow for flexibility in terms of updating and adding content. It is also designed for adaptability to user requirements changes. Response time: the application responds to users in real time with minimal delay. Scalability in the application to allow for future changes and adding more functionalities. Usability: the application is easy to use by the users, navigating from one item to another and easy to understand. In case of outage or unavailability of required data, there is a pop –up making it known to the user of the errors encountered or being experienced.

Chapter 5 Implementation and Testing

5.1. Introduction

Implementation of the application is the actual product realisation. As per Rouse 2015, implementation is the carrying and execution of any design or idea. Realisation of the product require that testing be done to heck for bugs. Rouse 2015, defines testing as checking whether something works. For purposes of this research this will entail coming up with a test plan to verify that the application is working. The test plan will include individual test cases.

5.2. Programming/Coding

The project has been developed using the following tools: PHP Language: This has been used to save and retrieve data dynamically from the server. This is in the form of PHP scripts. MySQL which has been used to save data as sent by a user. Hosting platform: This is essential to ensure easy and convenient accessibility of the application. XML: This has been used on the Android application for creating the activities for the application. Android phone: This will be essential for accessing user geo-location data to tag the anti-stigma messages. Android studio: tool used for running the source code and device emulator.

The database elements have been linked where required as described in the entity relationship diagram, in each attribute, there is a unique key or identifier. Also, the primary data has been clustered in different procedures and the underlying logic is based on the data flow diagram as described in figure 4-12.

5.3. Phases of development

The development will involve four main phases as in Table 5-1. The first phase will involve the general view of the main interface. This is the icons, colour and general interface without data validation. The second and third phase will run almost concurrently where the application and database are integrated. Testing will run from phase one to three checking the acceptance test, usability and functionality for the various units and the system.

Table 5-1 Phases of development

Phase One	Mobile and Web UIX
Phase Two	App development
Phase Three	Web service integration
Phase Four	Testing and finalization

5.4. Testing Plan for the System

The system was tested by unit testing, integration testing and system testing using the black box method. Each module will be tested separately, the different modules will then be tested together and after completion, the whole system will be tested as one. This was geared towards giving the satisfaction that the application works as required. Testing for the different application components will also be done in order to give a clearer view of the system scalability as well as the fault tolerance.

An administrator should interact proactively with the administrator window to fit the requirements and make any changes to the information.

5.4.1. Test Plan

The system was tested using the black box method. This is where the whole idea is to examine the functionality of the application. The internal structures and workings of the application are not a focus of testing for this method. The programming code is also not a focus for the black box testing method. This testing method was applied to every level in the testing which includes; unit, system and acceptance testing. System testing is where the whole application is tested entirely to verify that it is working as expected when all components are inter-linked together. Acceptance testing verifies whether the application does as is expected and its ease of use. Ease of use is how a user navigates through the application from one item to the other.

5.5. Actual System tests

The actual tests will involve as explained in Table 5-2.

Table 5-2 Actual System tests

Test Case Summary	To test if all components of the application are working as expected
Related Requirement	Accessing HIV related information via the mobile app interface
Prerequisites	Internet and Android enabled phone availability
Test Procedure	Step-by-step procedure to execute the test.
Test Data and test tools	Network/Internet access Android phone Google map
Test Environment	Android phone, web browser, MySQL database, laptop
Expected Result	A user should be able to view HIV information using their android phones. The administrator should be able to update information on the database The user should be able to tag anti stigma messages All the information should be stored in the database Professional/moderator should be able to view initiated chats
Actual Result	An end to end working mobile based HIV application
Status	Pass- Means the tests are successful Fail-Means the tests have failed Not Executed– Means the testing is not performed Blocked-Means testing is blocked.

5.6. Test Results

This section captures the expected outcome from the different scenarios in which the application will interact with the users and other factors. If the outcome is opposite of what is expected, then the requirements should be reviewed and code has to be corrected. This is to ensure that good quality assessment is done for a fully-functioning application.

5.6.1. Test Scenario One

The first scenario was whether a registered user can start a chat. A user either Registers or logs in to start chat. The messages sent will include an offensive word for which the test will verify whether the word is filtered or not. The user enters an offensive word in the chat window and the output should be as in Figure5-1 showing a starred word. This is meant to curb use of damaging language as the essence of the chat is to encourage and make one feel better. This is achieved by having a set of offensive words in the firebase database that are pre-defined. While a user starts a chat session he words are checked and if there is a match it is starred before being sent.

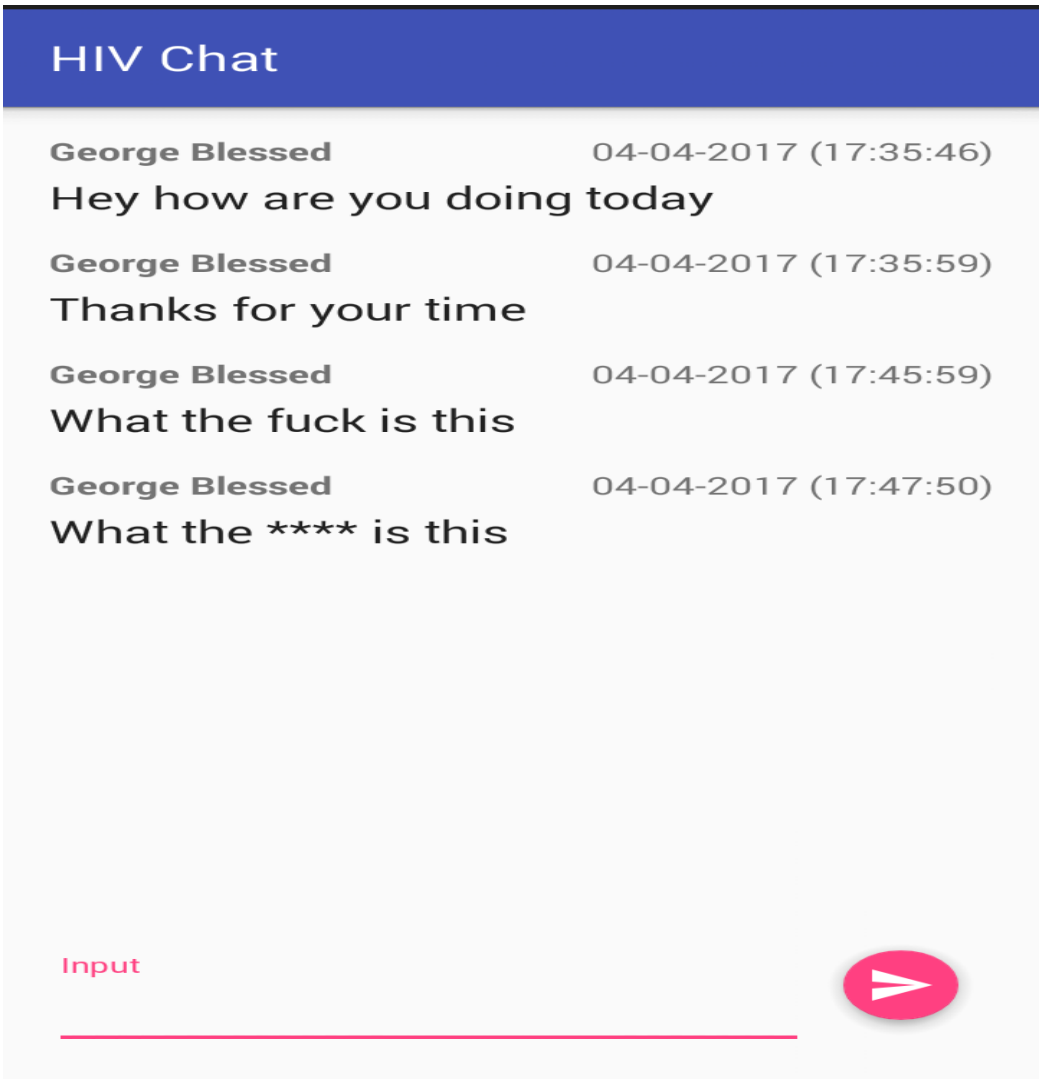

Figure 5-1 Chat filter

5.6.2. Test Scenario Two

The web interface is linked with the Android application from which users can download and use. Once the application is downloaded and the user should see the preview as is indicated in Figure 5-2.

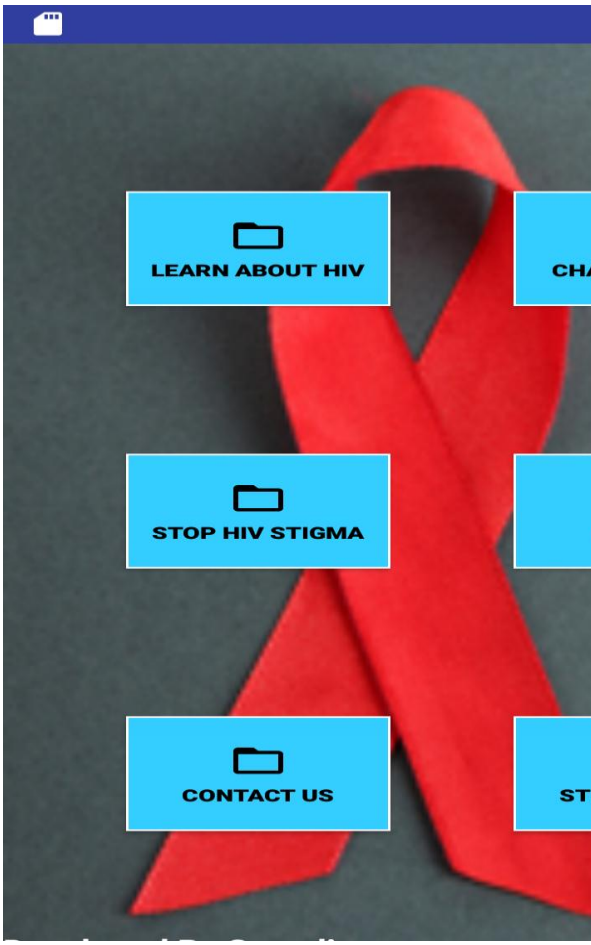

Figure 5-2 Main window

5.6.3. Test Scenario Three

Once a user tags an anti-stigma message or image, the window should appear as indicated in Figure 5-3. The location of the user is as shown in Figure 5-3.

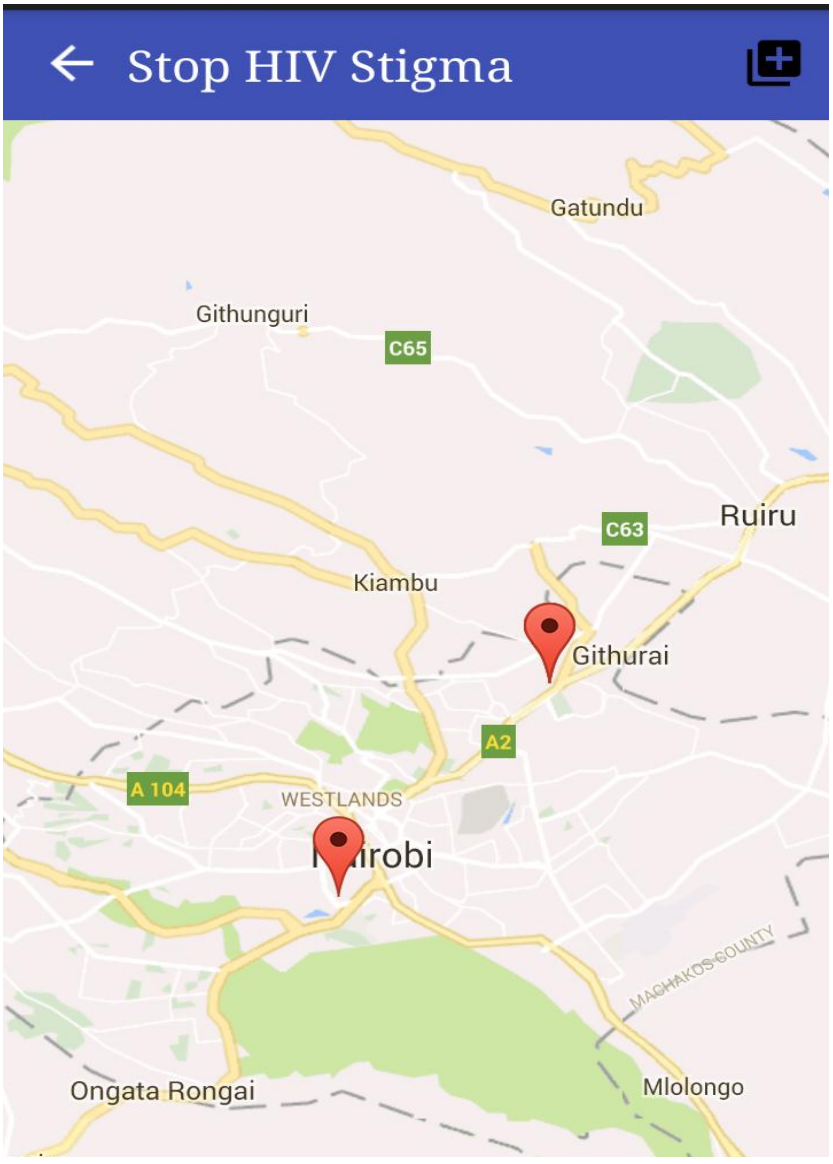

Figure 5-3 Anti stigma tags

Chapter 6 Discussions

6.1. Introduction

This chapter encompasses the interpretation and explanations of the results from the entire research. It answers the research questions comprehensively as well as digging deeper into metrics like appraisal of the key concepts and justification of the ideas mentioned. The discussion follows from the results and relates back to the literature review. The focus of this section is to state the opinions, implications of findings and suggestions for future research. Following are the parameters that will be discussed regarding the application.

6.1.1. Interface

The application has a user-friendly interface which creates an interaction between the users that is easy to understand and navigate. One of them is the web interface which operates on a close to real-time mode since it will automatically update in case of information updates. The overall outlook of the application is such that all items are on one window from which a user

chooses what to view at a certain time. From the use cases, all the actors have a role to play in the successful operation of the application. The users interacting include the facilitator: moderates a chat session. The Administrator: updates information and manages the database. The professional: gives a professional perspective to user questions and chats. A user who views information, start chat, tag a message and seek professional advice or assistance.

6.1.2. Performance

The system is expected to perform optimally based on the runtime environment. The Internet is one basic requirement because it is entirely web based. This implies that, if the Internet is down, the chat function in the application is not available. It is web-based as technology continues to evolve with more solutions focussing on web based and mobile based solutions.

6.1.3. Accuracy

The accuracy of the application solely depends on the information. The accuracy specifically means that the information that users are viewing as regards to the HIV information is accurate and updated. The geo tagging location coordinates should be accurate such that a user location is well identified. The data collected that informed the application will require to be reviewed over time. This is due to the changing features of improved access to care, Internet, environment and other structural factors. Treatment and prevention methods may change due to varied reasons hence the application needs to be dynamic and accurate at any given time.

6.2. Functionality and Correctness

This application has been developed to address HIV stigma and information access. The mobile application is supposed to help a user get updated information on HIV. It also assists a user to chat with others while seeking support, more information, real experiences of others and coping mechanisms. Previous studies HIV stigma measures have not factored in the use of Information Technology to measure stigma. The measuring of the stigma levels will be used to get closer to measuring stigma index using basic computing as opposed to the standard questionnaires only.

6.2.1. Contribution of the study

The mobile application could be used for education as an education tool in the HIV curricula. This will assist in reducing the stress that some teachers go through in explaining HIV related information. Considering that current methods of reducing stigma include the use of posters, radio and television, the use of geo tagging of anti-stigma messages adds to the different ways of reducing stigma and increased awareness regarding stigma. Support groups could also move to the use of support on the mobile application as currently there are many users of smartphones. It would be easy to link PLHIV with advocacy service in case they need help with such services. Assuming the government and activists are linked in the system, the likelihood of development of better policies that involve PLHIV towards reduced stigma and discrimination is heightened.

Chapter 7 Conclusions and Recommendations

7.1. Conclusions

HIV/AIDs stigma and discrimination remain a challenge in Kenya which deters those who would wish to have access to HIV care. This is in terms of testing, treatment, disclosure and long term care. The mobile application has benefits such as ease of access, ease of use, affordability and user convenience. Searching of information can be advanced to include specialized services like how to videos, one on one kind of communication with the user via tools such as Skype.

7.2. Recommendations

Decision makers could use the information on stigma to identify interventions that could help in reducing stigma and further improving access to care. They could also see how well to

integrate the education section in the curriculum on HIV/AIDS with the education curricula. This study was limited to the Nairobi area which may not be the best representative of the whole population. It is therefore recommended that data from other sources be considered to further improve the access to care by PLHIV and lower stigma levels. HIV stigma index measure being a more resource intensive process in terms of computation could be considered and its implementation in the form of a mobile application considered.

7.3. Suggestions for future research

In the future work, the possibility of using dongles to assist in early detection of one's HIV status within one's privacy may be considered in the Kenyan context. An easy validation tool may be added for the stigma index measure. Stigma index is a longitudinal kind of measure which has many factors to consider which includes a lot of questions. A real-time update of information may be considered in terms of drugs used to treat HIV and interaction of hospitals and care givers in the application. The use of frequently asked questions (FAQs) could be considered as a more proactive way of information access. This means, as soon as new medicines come out the user can be notified. The use of Natural Language processing for moderating the chat session would be considered other than having the offensive words populated in the database.

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Appendices

Appendix A: Questionnaire

Section A: Demographic Data. Please mark appropriate box with a "✓"

1. Age in years

Less than 18yrs	
18-45 years	

46-60 years	
over 60 years	

2. Gender

Male	
Female	

3. Marital Status

Single	
Married	
Separated	
Divorced	
Widowed	

4. Education level

Less than standard 8	
Less than form 4	
Tertiary or college	
University	

5. Do you know your HIV STATUS?

Yes	
No	

6. To whom have you disclosed your status

Colleague	
Partner	
Parent	
Friend	
No one	

7. How long have you known about your current status

Less than 1 year	
2-5 years	
6-10 years	
More than 10 years	

8. Any support group participation

Never attended a support group	

Would like to attend but do not know of any support group	
Attended support group meeting once in a while	
I have no idea about support groups	
Attended support group meetings regularly	

Section B: Multiple choice questions

Please mark appropriate box with a "✓"

Knowledge about prevention and control

HIV can be transmitted by sexual intercourse	YES	NO	DON'T KNOW
HIV can be transmitted from mother to child			
HIV can be transmitted by sharing needle or syringe			
HIV can be transmitted by blood transfusion			
HIV can be transmitted by shaking hand			
HIV can be transmitted by wearing the same clothes of an HIV-positive person			
HIV can be transmitted by eating and drinking from the same plate or glass of an HIV-positive person			
HIV can be transmitted by sharing a toilet with an HIV-positive person			
HIV can be transmitted through a mosquito bite			

Please mark appropriate box with an "✓"

Attitudes towards people living with HIV/AIDS

If one of your relative, who is HIV positive, becomes ill, would you be willing to care for her/him in your house or community?	YES	NO	DON'T KNOW
If your friend is HIV positive, would you continue your friendship with him/her?			
If a shopkeeper or food seller is HIV positive, would you buy items from him/her?			

If a student is HIV positive, she/he should be allowed to continue his/her study in school?			
If a teacher is HIV positive, she/he should be allowed to continue his/her teaching in school?			
Have you ever experienced any discrimination at the workplace?			

Source of Information

From what sources do you get information concerning HIV? Tick all that apply with a "✓"

	Television /Radio	
	Internet	
	Social sites(Facebook)	
	Posters	
	Doctors and nurses/hospital	
	School	
	Magazines/Newspaper	
	Friends	

Perception of support group

Please mark appropriate box with an "✓"

What kind of support group do you prefer?

Question	Strongly Agree	Agree	Disagree	Strongly Disagree
I prefer support groups that are separated into male and female				
I prefer a small size support group				
I prefer a support being facilitated by professional person				
I prefer a group being facilitated by other people living with HIV				

What is your opinion of support groups?

Question	Strongly Agree	Agree	Disagree	Strongly Disagree
Support groups are for people who are not able to cope with their HIV status				
Support groups are for people without knowledge on HIV/AIDS				
Support groups are of no use				

Support groups are for people seeking love and acceptance				

Why may you not want to participate in support groups?

Question	Strongly Agree	Agree	Disagree	Strongly Disagree
I have enough support				
I do not like support groups				
I do not have transportation to and from support groups				
My parents/spouse refuse that I join a support group				
Support groups are hard to find where I live				

Mobile phone access

Do you own a mobile phone? Tick as appropriate

Yes	
No	

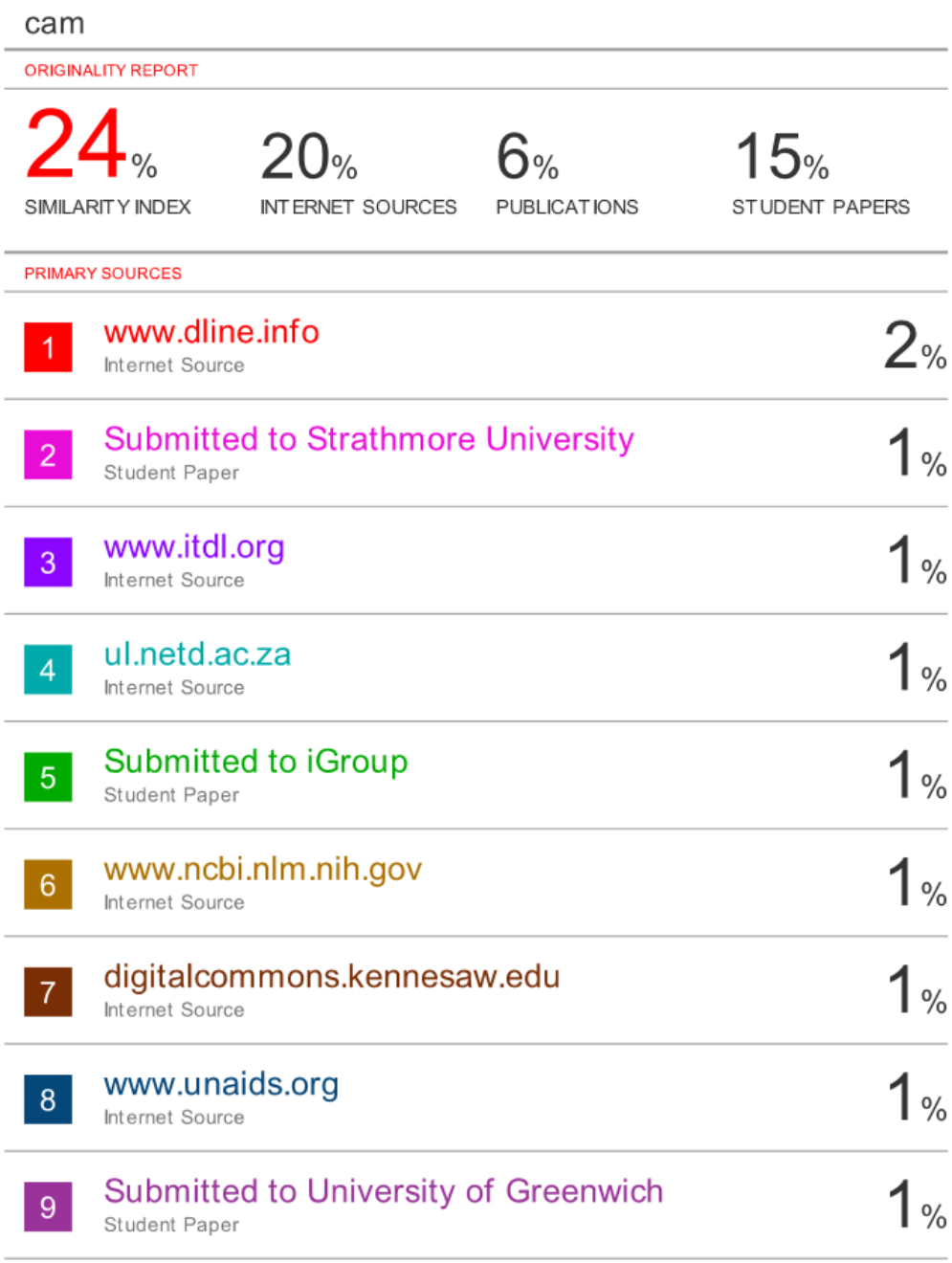
Appendix B: Sample Code

```
<?php
class myclass {
   function myclass()  {
      $user = "root";
      $pass = "";
      $server = "localhost";
      $dbase = "hiv";

         $conn = mysqli_connect($server,$user,$pass,$dbase);
```

```
        if(!$conn)
    {
        $this->error("Connection attempt failed");
    }

        $this->CONN = $conn;
    return true;
  }

        function close()  {
                $conn = $this->CONN ;
                $close = mysql_close($conn);
                if(!$close)
                {
                   $this->error("Connection close failed");
                }
        return true;
        }
        function sql_query($sql="")  {
                if(empty($sql))
                {
                   return false;
                }
                if(empty($this->CONN))
                {
                   return false;
                }
                $conn = $this->CONN;
                $results = mysqli_query($conn, $sql) or die("Query Failed..<hr>" .
mysqli_error($conn));
                if(!$results)
                {
                   $message = "Bad Query !";
                   $this->error($message);
                   return false;
                }
                if(!(preg_match("/^select/i",$sql) || preg_match("/^show/i",$sql)))
                {
                   return true;
                }
                else
                {
                        $count = 0;
                        $data = array();
                        while($row = mysqli_fetch_array($results))
                        {
```

```
                        $data[$count] = $row;
                                $count++;
                        }
                        mysqli_free_result($results);

                        $json = json_encode(array("items"=>$data));
                        return $json;
                }
   }
}

$obj = new myclass();
if(isset($_POST['query']))
echo $obj->sql_query($_POST['query']);
?>
```

Appendix C: Turn-it Report



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